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Rough Notes of an Exploration for an Inter-oceanic Canal Route by way of the Rivers Atrato and San Juan, in New Granada, South America.

By JOHN C. TRAUTWINE, Civ. Eng., Philad.

(Continued from p. 154.)

In my first communication respecting this route, my remarks were confined chiefly to a few general observations on the Gulf of Urabá or Darién; and the bars which impede the entrances, mouths, (or bocas,) of the several streams, (caños,) which form the delta of the Atrato; and through which that river discharges itself into the gulf.

In this, I shall proceed in the same manner, to furnish some brief notes, with regard first to the caños themselves; and afterwards to the main River Atrato.

In sounding the caños, below the junction of Caño Coco Gránde with the Atrato, we did not take as many entire transverse sections of the wider ones, as I could have desired. This portion of my operations was performed in a light canoe; and, inasmuch as the proposed object of my mission would be fully accomplished, provided a low water depth of 10 feet could be secured throughout, I frequently satisfied myself with that depth near the shores, rather than encounter the intense heat of the sun, and the greater rapidity of current in midchannel. Under a pressure for time, and the necessity of traveling sometimes forty miles a day, with but two paddlers, it was on more occasions than one, necessary to sacrifice scientific considerations to strictly utilitarian ones.

In ascending the river above the divergence of the caños, opportunities for obtaining entire cross-sections of the stream, frequently presented themselves; as our patron, or captain, always sought the convex sides of the bends in the river, to diminish the labor of his polers or bogas, as the crew are called.

I had, moreover, become previously aware, that no attempt could be made to render practicable, the *entrances* to these wider caños; so that we might even have omitted to sound them at all, so far as the immediate object of my exploration was concerned.

Descending Caño Taréna, below its confluence with Caño Barbacoas, (see Plate I,) the average width varies between 250 and 300 yards. My least sounding near the shores, until within a short distance of its mouth, was 20 feet: but when we were pretty well out in the centre of the stream, the depths generally ranged between 30 and 45 feet. On the convex side of one of the bends, we found 78 feet.

The only shoal spot in Caño Taréna, is opposite the entrance of an extensive lagoon, (see Plate I,) which discharges itself into it on the west bank, at about a mile from the gulf; bringing in soft mud, which forms the shoal.

Our soundings here gave depths varying from but 18 to 22 feet, clear across the caño. Immediately below this shoal, however, we found 28 feet; but below that again, the depth gradually diminished to the mouth.

Caño Barbacoas is, like Taréna, a very beautiful stream; having an average width of from 150 to 200 yards. It is by no means so deep as Taréna. In this caño, also, I contented myself with a depth of 10 feet; but from a few observations taken entirely across, I think it highly probable that a careful series of soundings would indicate a continuous channel of from 12 to 15 feet.

Caño Pava has an average width of from 120 to 150 yards; and a channel way of full 20 feet deep throughout, with the exception of about one-third of a mile of its length next inside of the boca. Descending along this third of a mile, the depth gradually decreased as we approached the mouth; which I found to be very much obstructed by sand from the gulf. None of these three caños, Taréna, Barbacoas, or Pava, has bends so abrupt as to oppose any difficulty whatever to steamboats of the greatest length afloat.

Caño Candelaria is a short, secondary outlet to Caño Pava; (see Plate I.) Its length does not exceed a mile; and its greatest depth (except at its confluence with Pava,) is but 12 feet. It is somewhat obstructed by sunken trees, and appears to be filling up. Caño Urabá was examined only for a short distance at each end. So far as I saw it, it had a width of from 60 to 80 yards, and a safe center depth of at least 25 feet at low water; except near its mouth, where it is wider, but shallower; (see preceding Table of bars.) Even close to its banks, my soundings gave 15 to 20 feet; and nearer the middle of the stream from 25 to 35 feet.

From my acquaintance with similar caños in other parts of New Granada, I have no doubt that a perfectly clear passage for large steamboats exists throughout its entire length, after having once cleared the entrance. Should it present any very sudden bends, they could easily be straightened by dredging.

Caño Coco Grandé is of about the same character as Urabá, as regards width and depth.

Caños Piguindé and Pántano, are but short secondary outlets to Urabá and Coco Grandé respectively, and require no especial notice.

The only one, therefore, that remains to be mentioned, is Caño Coqúito. This is, as before remarked, the most insignificant of all the mouths of the Atrato, (except Piguindé and Pántano, which scarcely deserve to be regarded as separate mouths.) The grounds have also been stated, upon which, notwithstanding its present condition, I should select it in preference to any of the others, for adaptation to a system of improvement on a small and inexpensive scale.

These were, that its entrance is more sheltered from the effects of the Northers, by the Isla de los Muértos; and therefore less liable to periodical changes, or obstructions, from that source. Indeed, from all I could learn, (and the representations made to me were sustained by appearances,) it is almost entirely free from them. The depositions which obstruct its entrance, extend, it is true, to a considerable distance out from the shore; (see Table of Depths, page 149.) But they consist of soft mud brought down by the river, and easily removed by the processes already alluded to; and when once removed, I conceive that the slight current produced in the artificial channel, would prevent their reproduction by forcing them out into deep water.

It may be objected to this plan, that even in deep water, the process of deposition will still continue, and eventually require further appliances; but admitting the force of the argument to the fullest extent, I still conceive that ages might elapse before serious difficulty would arise from that source.

A minute survey might show that it would be a preferable plan, to cut an entirely new channel for uniting Caño Urabá with the gulf, at a point about 3 miles south-west from its present mouth. For larger vessels than those contemplated in my survey, I am confident that this would be far better than to use Caño Coqúito; and possibly it is so in any event.

When we prepared to leave the gulf, in order to ascend the Atrato in the large river boat, in which we had made our voyage by sea from Carthagena, we had to wait for the hour of high water, before we could enter Caño Coqúito. High water gave us a depth of but 3 feet 4 inches for some distance from the entrance, and as the loaded boat drew 3½ feet, and the rudder 4½ feet, we stuck fast.

By unshipping the rudder, however, and putting a portion of the crew into the water to buoy up the vessel, while the remainder plied their palancas or pushing-poles, we passed through the mouth, when we instantly found ourselves in nearly two fathoms of water.

Caño Coqúito is two miles long, and has a width varying generally from 25 to 35 feet, between the bushes at its sides. In some few spots it is narrower, not exceeding 15 feet, and in others, as wide as 50 feet.

It affords a low-water depth of 10 feet, except over some few very short bars, caused probably by sunken trees. The shoalest of these bars occurs about 200 yards before reaching the junction with Caño Barbacoas. Here we found but 5 feet low-water depth; extending, however, a distance of less than 100 feet. The soft mud and vegetation at the

sides of this caño, could be removed without difficulty, by a dredging machine, and some little chopping; and a channel-way formed of 40 feet in width and 10 feet of low-water depth, at an expense of labor and money, much less than would be required to improve the entrance to any of the other caños.

Subsistence for laborers could be procured from either Carthagena, or Navy Bay. They should sleep in vessels prepared for the purpose.

It will be remembered, that the only class of improvement to which I have reference in my remarks, is that adapted to small steamboats, or other river craft, such as could at almost all times ascend the Atrato to Quibdó, some 220 miles, with a draft not exceeding 6 feet.

The boat in which we traveled from Carthagena to Quibdó, was 68 feet long from stem to stern, and 13 feet beam over all. Draft of hull, $3\frac{1}{2}$ feet; of the rudder, $4\frac{1}{2}$ feet.

The convex sides of bends in the caños, (and, as I afterwards found, in the river also,) being shoaler than the opposite, or concave sides, give luxuriant growth to a species of coarse aquatic grass, here called grammalóte, which, in appearance, somewhat resembles young corn; and also to varieties of the arun, or spatter-dash. The greater depth of water on the concave sides, prevents the growth of these plants; and the trees approach to the very edge of the stream, which their branches overhang. The trees are frequently concealed by dense masses of vines which entirely envelope them, and in certain lights present plays of color comparable only to those of the richest velvet; and which, contrasted with the magnificent plumes of the pángana and murápo palms, afford a display of nature's handiwork, at once unique, gorgeous, and chaste. But like the plumes and velvet of the funeral pageant, they serve but to conceal and adorn corruption. Behind them stretches, far away, the pestiferous swamp, through the dreary wilds of which even the birds refuse to sport; and whose silence is broken only by the sighing of the breeze, or the sullen growl of the roving tiger. The pinnated leaves of the palma pángana are frequently from thirty-five to forty feet long; and springing out from the trunk of the tree at only a few feet from the ground, they precisely resemble in shape and gracefulness, gigantic plumes of ostrich feathers.

On our way along Caño Taréna, we came across a shelter of branches erected on the shore, and temporarily occupied by a family of blacks. Their occupation was fishing; and hunting a kind of wild hog, (the Peccary,) which is occasionally met with in the swamps, during the dry season.

Being the first amphibious human beings we had yet encountered, we made them a friendly call for a few minutes; and purchased from them half a large peccary for half a dollar. These were the only persons we met with in any of the caños. Their canoes were constantly kept ready for a start, inasmuch as a very slight flood would suffice to drown them out.

While descending this same caño in our canoe, we saw the planet Venus with perfect distinctness, and in an unclouded sky, while the sun was shining with full brilliancy, but a few degrees below it.

The manati is abundant in these caños, and for a long distance up the

river. It appears to feed chiefly upon the grammalóte; we frequently saw considerable patches of that grass gnawed off close to the water; and were told that it was the work of this animal.

Although for some years employed in caños in New Granada, abounding with manati, I never saw but one, and even that very indistinctly. It was walking on the bottom of the caño, some feet under water, and passed beneath the boat in which I happened to be at the time. It was of the size and color of a small dun cow. We did not see a single alligator until we had ascended the river some leagues above Caño Urabá. They appear to be somewhat rare in the Atrato.

The only birds we met with in the caños were one or two cranes.

Venomous snakes abound; and are a source of dread to the river boatmen. They repose coiled up among the branches of the trees, overhanging the streams, and not unfrequently are precipitated into the boats by accidental blows of the paláncas, or pushing poles.

The bogas, or crew, are constantly on the look-out for them, and by long practice become wonderfully quick in detecting them. We kept our guns ready loaded for the purpose; and killed several almost every day, to the great gratification of the bogas, who always evinced their pleasure by loud "vivas." Those we shot were generally from four to six feet long.

Wasps are another occasional source of annoyance; and, like the snakes, are regarded with great aversion by the bogas. Our patron appeared to know every wasp's nest between the Bocas and Quibdó; and always gave us timely warning to enter the cabin, and hang up blankets at the doors to prevent their entrance.

The bogas, who at other times are constantly singing, preserve perfect silence on approaching a wasp's nest; and take especial care not to touch with their paláncas, the trees in which they are built. By this means they generally escape being stung.

The wasps are of two species; the larger ones do not sting, unless provoked; but the smaller ones are less considerate, and appear to fight for the fun of the thing.

Instead of entering into a detailed description of the Atrato, I will confine myself to such an outline of its chief peculiarities as will suffice to convey a tolerably correct idea of its general character. In doing this, I shall adopt such subdivisions as suggest themselves to me at the moment of writing; filling them in by remarks hastily taken from my several books of memoranda.

The Natural Levees of the Atrato, extend from the Gulf of Urabá or Darién, almost to the very sources of the river; or up to those points on its several tributaries, at which it begins to assume the character of a torrent.

Although the banks or levees of the caños, (as well as those of the river for a great distance above them,) consist of soft mud; still they do not slope very gently towards, and beneath the surface of the water, as might be supposed. On the contrary, they descend quite abruptly to a considerable depth; so that it is common, in straight reaches, to have nearly the same soundings close to the edges of the stream, and in its

center. For miles at a stretch, we found depths of from 18 to 30 feet, within from 20 to 50 feet of the shores of the Atrato, as well as those of some of the caños.

Near the Gulf, where the tide rises generally about 18 inches, the height of these levees varies from but a few inches, to a foot above the ordinary level of high water.

Their height above the ordinary stages of the river increases as we ascend, but still is subject to variations of several feet throughout. The depth of their highest points below the highest flood-stages, appeared to be more uniform; being ordinarily comprised between one and three feet, throughout the course of the river.

Thus at the mouth of the River Súcio, which I estimate at 61 miles above the mouth of Caño Coqúito, I found, by leveling, that the height of the greatest freshet known for 20 years, and which occurred in November and December, 1851, was 8½ feet above the very low stage of water at the time we arrived at that point. Its marks were shown to us, and it had overtopped the highest portions of the levees 3 feet. Consequently, the levees were 5½ feet above the same low stage of the river, which was as low as had been known for some 4 years.

At Vigía Curbaradór, about 96 miles above the mouth of Coqúito, the same freshet had risen about 10 feet above the same low stage; overtopping the highest levees about 2 feet.

Opposite the mouth of the Napipi, the highest points of the levees are 11 feet above very low stages of the river; and here I was shown the marks of the great flood of 1851, which proved to be 13 feet above a very low stage of water; and overtopped the highest parts of this levee some two feet. This point is 135 miles, (by my estimate,) above the mouth of Caño Coqúito. In Tevída, 149 miles above the mouth of Coqúito, the great flood of December, 1851, rose about 18 feet above the lowest stages of the river.

At Quibdó, (220 miles above the mouth of Coqúito,) from 12 to 15 feet above extreme low water, is quite a common occurrence; and the former may indeed be regarded as about the ordinary stage of the river at that place.

Approaching Quibdó, the levees are frequently full 20 to 22 feet above the lowest stages of the river, and are overtopped at times as much as 2 feet, which gives for the height of the greatest freshets about 24 feet above the lowest stages.

Above Quibdó, the levees gradually *decrease* in height, until near the head of canoe navigation they are but from 3 to 6 feet above the very beds of the streams.

The sides of the levees which front on the river are generally quite steep; but those on the land side, (or, more properly speaking, on the swamp side,) slope away gradually from the top.

The trees which grow on the levees are both larger and much more numerous than those in the swamps. In the latter they are frequently very sparse and stunted, amounting to mere shrubs.

It is manifest that but little space is available for the purposes of cultivation in the immediate vicinity of the river. Being confined almost

exclusively to the tops and land slopes of the levees, clearings rarely have a greater width than from thirty to fifty yards.

Until we ascend the Atrato as far as the mouth of the River Súcio, sixty-one miles above Boca Coqúito, not the slightest attempt at cultivation is seen, in consequence of the wet, spongy character of even the levees themselves. Indeed, the first huts to be met with are at the mouth of the Súcio.

Even above the Súcio, we saw but one or two of the meanest description, until we reached Vigía Curbaradór, which is ninety-six miles above Boca Coqúito. (See Plate IV.)

Above the Vigía they become much more numerous, several being frequently in sight at a time, each with its little patch of cultivated ground.

Plantains, yams, sugar-cane, and corn are the principal articles raised. To these may be added a few beans, tomatoes, red peppers, yuca, lemons, oranges, cacao, and rice. Scarcely a mouthful more is produced than will suffice for the bare subsistence of the occupants of the huts; so that considerable difficulty is frequently experienced by the boatmen in obtaining supplies during their trips along the river.

After ascending some 140 miles above Boca Coqúito, or five miles above the mouth of the Napipi, the monotony of the levees begins to be occasionally broken by low bluffs of stiff clay; and still higher up by bluffs of clay and pebbles.

Below that distance, I remember only the Cerro, or Hill of Tumaradór, twenty-three miles above Boca Coqúito; and the Loma, or Hill of Cacarica, thirty-four miles above the same point.

The former is a small isolated cone, perhaps 100 feet high, on the east side of the river; and the latter a low range of about the same height, and some five miles long, on the west side. It, together with other ranges much higher, and to the west of it, we saw stretching away Northwardly towards the Carribean coast. Views of spurs of the Cordilleras frequently present themselves to the East. Many of them are striking, but none grand.

The elevated bluffs just mentioned are sometimes selected as sites for the erection of huts; but more generally these are built on the narrow summits of the levees, which are better adapted to the primitive processes of agriculture which prevail here, the soil being richer and more easily worked. The only farming implement employed is the machéte, or long knife, which answers in turn for axe, carving-knife, plough, fighting, grave-digging, and various purposes to which more complex machinery is adapted by other people.

The houses are necessarily placed on stilts, so as to be beyond the reach of floods; and their floors, which are thus raised from three to six feet above the summits of the levees, afford an excellent gauge for determining high-water-level.

During such floods as overtop the levees, and inundate all the back country for a great distance, not only the inhabitants, but also the dogs, hogs, and poultry take refuge in the huts, where they sometimes remain imprisoned for several days at a time.

Once, in the *dry* month of August, when Dr. Halsted and myself de-

scended the river, *from almost its very source*, to Quibdó, *all the levees throughout that distance were submerged by a flood*, and the huts resembled so many miniature arks, except that the unclean beasts greatly outnumbered the clean. (See Plate V.)

The material of which the levees are composed undergoes a gradual change as we ascend. Along the lower parts of the river it consists of soft mud mixed with leaves and logs; but further up, it by degrees, assumes a more firm consistency, until, on approaching the Napipi, it presents a soft, rich, loamy soil, filled with beds of dead leaves and logs. Still further up, it gradually acquires a clayey character, mixed with sand and gravel. The water of the swamps is continually seen percolating through the porous soil of the levees into the river, when the latter is low.

Neither a rock, nor a stone larger than common paving pebbles, is seen up to the very head of canoe navigation; nor, indeed, up to the low hill range which forms the line of partition between the waters of the Atrato and San Juan; and which itself consists of gold-bearing gravel and clay, without rock.

I should except a heap of small boulders, at the water's edge, on the East bank of the river, some thirty miles above Boca Coqúito. On the published maps these are marked "Pulgas," or "the Fleas." How they got there I cannot imagine. We passed on the opposite side of the river, and, consequently, did not examine them.

Widths and Depths of the Atrato, *between the Gulf of Darién and Quibdó.*—When once inside of the bocas, and above the shoal spots already spoken of in Caño Coqúito, there is a sufficient channel for steamboats drawing six feet water, as far as Quibdó, (or 220 miles,) for about 300 days in the year. The intervals at which the river is lower are very irregular, and continue from a day to a week or more at a time, depending on its constant fluctuations.

Up to the Vigía Curbaradór, ninety-six miles above Boca Coqúito, measured by the windings of the river, the width generally varies between 250 and 350 yards. In some few spots it is wider, and in others narrower.

Throughout this latter distance there is a channel of sufficient width and depth for the largest ocean steamers.

At the River Súcio, sixty-one miles above Boca Coqúito, I found the width to be 1050 feet, with a low-water channel-depth of fifty feet.

At seventy-five miles, the width was 950 feet—the low-water channel-depth, forty-five feet.

At Vigía Curbaradór, which I made latitude 7° 5' North, the width is 700 feet—the low-water channel-depth, thirty-six feet.

In many intermediate spots, I found depths of from sixty to seventy-five feet; and by following a more serpentine course, so as to hug the concave sides of bends, a steamer could carry forty feet, at low water, up to the Vigía.

For a few leagues above the confluence of Caño Coqúito and the Atrato, we had occasionally but forty feet soundings, in spots where the river was widest. I do not hesitate, therefore, to assert, that at the very

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J.C.T. del.

SWEDISH CANOE.

P.S. Duval & Co's Steam Lith. Press. Philad.

lowest stages of the Atrato, a perfectly safe channel-depth of at least thirty-five feet may be carried up to the Vigía.

In the foregoing channel-depths I have not always given the deepest soundings at each spot, but those which afford, at the same time, a width sufficient for the manœuvres of large river steamboats. They have been selected from a great number, merely to show the rate of gradual diminution of depth as we ascend.

It was generally impossible to measure base-lines on shore, for determining the widths of the river, on account of the soft deep mud and the dense vegetation at the water's edge, as well as from my unwillingness to cause any undue detention of the boat, which was loaded with merchandize for Quibdó.

To obviate this difficulty, I was frequently obliged to assume the length of our boat (sixty-eight feet) as a base-line. At every stop, whether for meals or other purposes, Dr. Halsted would perch himself at one extremity and I at the other, each with a pocket sextant in his hand, and at the same instant (in order to counteract any trifling motion in the boat) take angles to some well defined object (generally a sapling) on the opposite side.

Our instruments were capable of reading minutes; therefore I suspect that our widths are never in error more than ten or twenty feet. Whenever we could, we measured a base-line on shore. I mention this, (as I shall other expedients,) merely to enable the reader to attach what degree of confidence he may see fit to the results.

We also took soundings, by means of our canoe, (with a line, carefully adjusted every day,) whenever the boat stopped; as also whenever she crossed the river, in order to hug the convex sides of the bends, for the sake of the less rapid current. From Mr. McCann's expertness in this operation, it was generally performed by him, while I noted down the results.

The small canoe, which we constantly towed astern, was brought into requisition very frequently. Dr. Halsted availed himself of it for gathering plants; and all three of us would occasionally use it together for examining a few miles of some tributary of the main river. When quietly towing in our wake, it answered for bath and wash tub; and after we had ascended above Vigía Curbaradór, it was used for running out lines for pulling our large boat off from sunken trees, upon which she sometimes stuck fast, as we hugged the shore.

Below Quibdó these trees rarely extend out more than fifty feet from the banks; but, after ascending some leagues above that point, they appeared completely to cover the bottom of the stream.

After passing above the Vigía Curbaradór, a rapidly increasing shallowness is perceptible in the depth of the river, which at this point divides into two channels. These unite again about a league above the mouth of the Napipi, a distance of forty-two miles. The Western one is called the Atrato, and the Eastern one the Caño Tadía.

At both the upper and lower junctions, Tadía has but about half the width of the main stream. I saw no other portions of it, but was told that its depth was fully equal to that of the principal branch. The space which they enclose is called the Island of Tadía.

Commercially considered, the depth of the Atrato possesses interest, chiefly when regarded in connexion with the proposed inter-oceanic canal routes, by way of either the Napipi or the San Juan.

Therefore, in my further remarks respecting it, I shall be guided by that consideration only; and instead of presenting a long series of soundings, varying alternately from shallow to deep, and from deep to shallow, shall merely state the depths that may be carried from the Vigía to the mouth of the Napipi—to Quibdó—and from Quibdó to the point of partition between the waters of the Atrato and San Juan.

Although I myself consider the project of a ship canal through either of these routes to be a perfectly Quixotic conception, there are some who do not coincide with me in opinion; and with the sincere hope that their views may be the correct ones, I cheerfully contribute what little I can, to the data upon which the preliminary calculations must be based.

We carried a *very low stage* of water with us all the way from the bocas to near the mouth of the Napipi, as low as the patron of our boat had ever seen in twenty years, and his statement was confirmed by all the persons living along the river, whom I interrogated on the subject.

Ordinary stages of the river are distinctly indicated by a line along the levees, below which no grass grows. This line was from three to four feet above the water, as we approached the Napipi. While at this very low stage, the most serious impediment, or rather the least limiting depth that occurs between the Vigía and the mouth of the Napipi, is eighteen miles above the former. The width of the Atrato here expands to 1100 feet, and the greatest low-water depth is fifteen feet for a channel-width of 250 feet.

Only a mile above this spot, the river contracts to 500 feet in width, affording a low-water channel-depth of 25 feet; and in many places between the Vigía and the Napipi we had soundings of thirty-five feet. Still some two or three more places equally shallow with that just mentioned occur before reaching the Napipi; so that we may regard fifteen feet as the minimum channel-depth, at the lowest stages of the Atrato, that vessels would encounter between the ocean and the mouth of the Napipi, a distance of 135 miles.

It will be borne in mind, however, that these lowest stages are of rare occurrence and of short duration; and that, for the greater part of the year, eighteen feet might safely be assumed as the ordinary one.

I think it probable that the most effective proceeding for obtaining an increased depth would be to stop up the upper end of Caño Tadía, about three miles above the mouth of the Napipi, assisting this process by dredging.

The most sudden bend in the Atrato, below the mouth of the Napipi, is but a mile from the latter point. Even it, would allow the passage of river steamboats of the largest class. It is shown on the map, (Plate VI.)

At half a mile below the Napipi, the Atrato is 925 feet wide; immediately opposite that tributary it is 740 feet.

Near the bocas the current appeared to vary from about half a mile to nearly a mile per hour; but increasing gradually as we ascend, it be-

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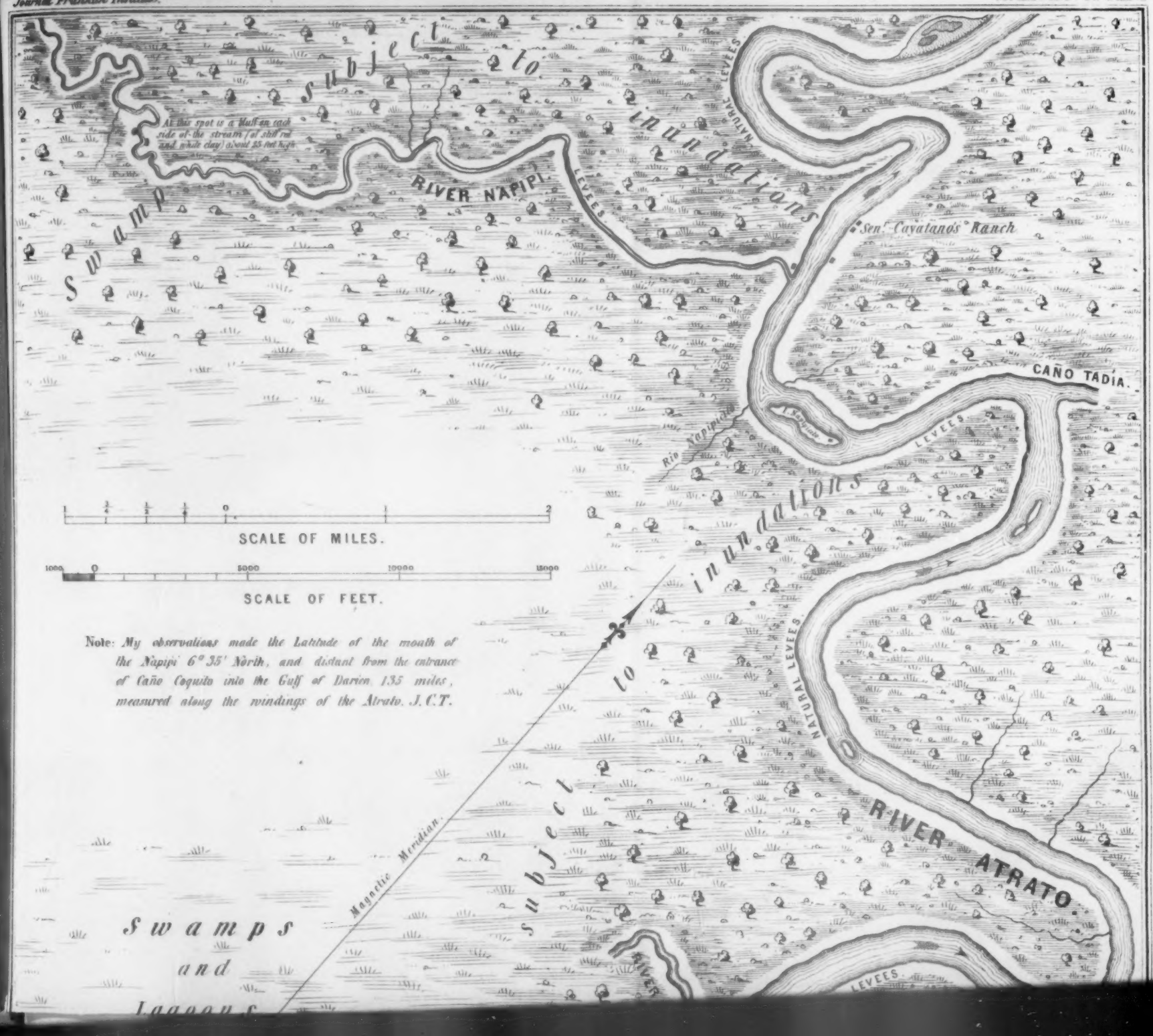
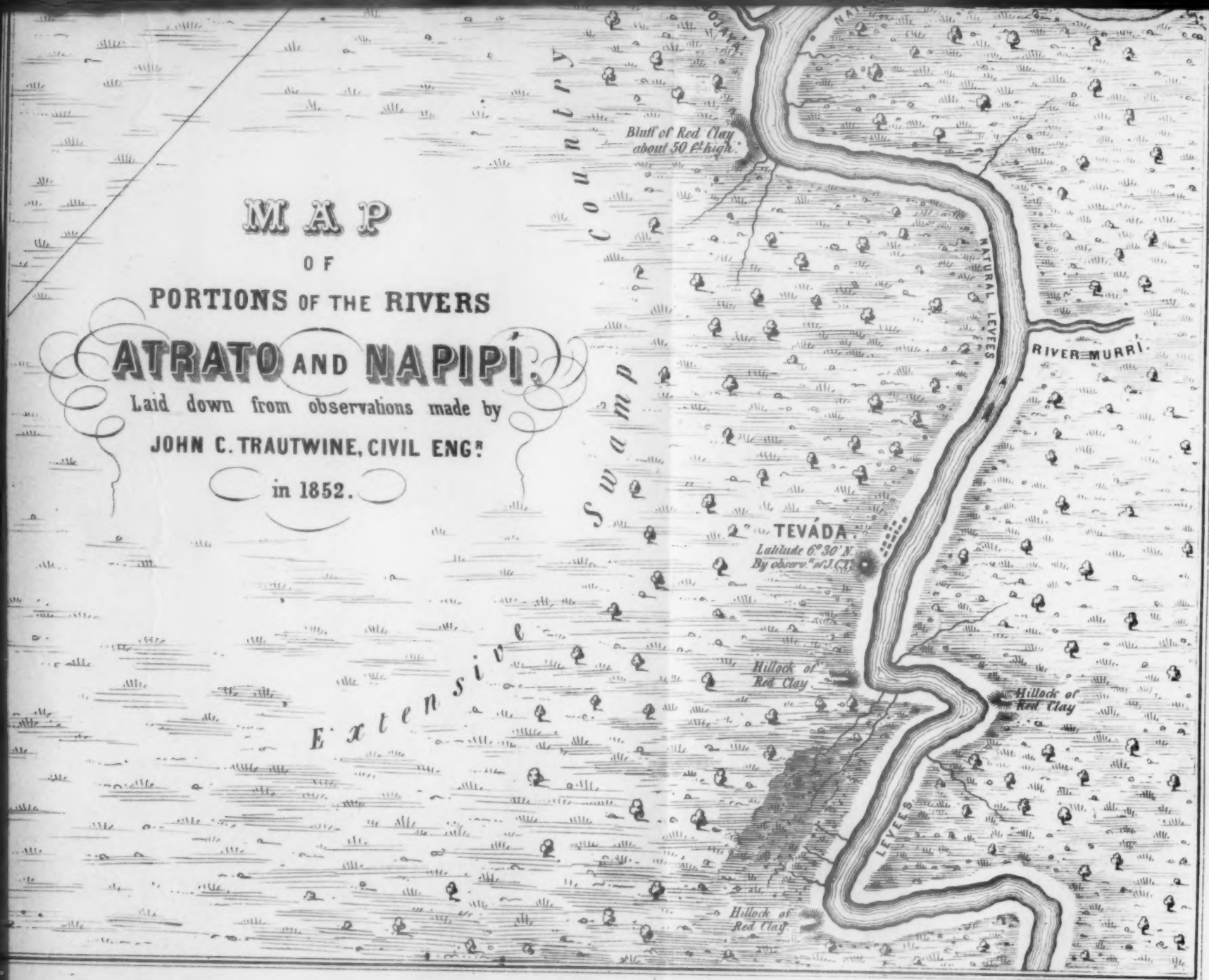
At half a mile below the Napipi, the Atrato is 925 feet wide; immediately opposite that tributary it is 740 feet.

Near the bocas the current appeared to vary from about half a mile to nearly a mile per hour; but increasing gradually as we ascend, it be-


Swamp subject to inundations
At this spot is a bluff on each side of the stream (of shell rock and white clay) about 25 feet high
RIVER NAPIPI.
LEVEES.
NATURAL LEVEES.
Sen.r Cavatano's Ranch
CAÑO TADIA.
Rio Napipi
LEVEES.
SCALE OF MILES.
SCALE OF FEET.
Note: My observations made the Latitude of the mouth of the Napipi 6° 35' North, and distant from the entrance of Caño Coquito into the Gulf of Darien 135 miles, measured along the windings of the Atrato. J. C. T.
Magnetic Meridian.
Swamps and Lagoons
RIVER ATRATO
LEVEES.



Lith of F.S. Duval & Co. Philad.a

came nearly two miles per hour, (at the low stage,) near the Napipi, except in narrow spots, where it was sometimes three miles.

THE NAPIPI.—Having now reached the mouth of the Napipi, and pointed out the capabilities of the Atrato for navigation to that point, we will, for a short time, take leave of the latter, while we examine a few miles of the lower portion of the former.

The stipulations of my engagement did not embrace or even contemplate an exploration of the Napipi route to the Pacific; nor did I, when I left the United States, intend to devote my attention to it, fearing that I might thereby prolong my proper survey into the rainy season.

But on arriving at the spot, and learning that above Quibdó the rainy season occupies the entire year, I found it impossible to restrain my desire to take, at least, a hasty glance at the lower portions of the Napipi. I had seen no reliable description of that river, and wished to form some general idea of its capacities for the important purpose to which it is so generally supposed applicable.

I, therefore, made arrangements for detaining our large boat at the mouth, while I should ascend the river in our small canoe. From this course, however, I was dissuaded by Señor Cayatáno, a colored man, who resides about half a mile below its mouth. He owns extensive tracts of levee along this portion of the Atrato; and in his buildings, cultivation, and improvements generally, evinces a degree of intelligence and energy in striking contrast with the almost brutal apathy of his neighbors.

He assured me that it would be very difficult, if not impossible, to ascend the Napipi with a canoe and paddles; and kindly lent me a boat of his own, with three men to pole her. This boat was 39 feet long, three feet beam, and fifteen inches deep; made, like all the boats here, from a single log.

Dr. Halsted, Mr. McCann, myself, and the three bogas, together with a box of provisions, and a change of clothes, constituted our load. We sat off without any definite idea of when we should return. That would depend upon the character of the stream. Should it prove to be a really fine one, we should cross over to the Pacific; otherwise, we should return without doing so. We did return on the evening of the same day.

The mouth of the Napipi is, by my observations, in latitude 6° 35′ North; and 135 miles from Boca Coqúito by the windings of the river.

Its width is just 100 feet, as measured by our tape line. The low-water depth at the same place, taken at three equi-distant points twenty-five feet apart, is eight feet, five feet, and two feet; but at a short distance inside it is greater. The Atrato had risen, on the day of our arrival, four feet above the extreme low water stage with which we had ascended the river, therefore, the depths, as we actually found them, were twelve, nine, and six feet.

Whenever we stopped, even for an hour, a gauge-pole was instantly planted, so as to inform us, several times a day, of the rate at which the river was rising or falling.

This was the first rise we had had since leaving the gulf, and it subsided almost as rapidly as it had approached.

We ascended the Napipi but eight miles. Along this portion I took the bearings and distances, as accurately as I could, from the boat; and Plate VI. (map) exhibits a protraction of them, together with one of the Atrato from the Napipi to Tevára, also from my notes.

Throughout the eight miles which we examined, the width of the stream was pretty uniformly about seventy-five feet; and its depth, as we found it, twelve feet in the centre, six to nine feet on the convex sides of bends, and from fifteen to eighteen feet on the concave sides; being equal to a uniform depth of twelve feet. The depths were about equal throughout the eight miles; and are near the ordinary ones.

There was a current of a trifle more than two miles per hour at the upper end of the eight miles.

The levees are generally from four to five feet above the level of the water; and, like those of the lower parts of the Atrato, consist of soft mud, leaves and logs; though near the end of our observations they were becoming more firm.

The freshet-marks were throughout about two feet higher than the tops of the highest levees.

Bottom, mud, with an admixture of fine sand near the upper end. From the very mouth, we found the bed of the stream to be literally paved with sunken trees. In many places they nearly closed it, so that we had difficulty in getting our boat along. In some parts they formed rapids, along which we should scarcely have been able to force a short canoe by paddles only. We had four hours of pretty hard work in passing up the eight miles, even with poles.

About three miles up we noticed a short bluff on each side of the stream. They consisted of red and white clay, and were some twenty or twenty-five feet high.

The branches of trees growing on opposite sides frequently interlock overhead. Among them we saw a few monkeys and toucáns. We also smelt alligators two or three times, but did not see them.

Some of Señor Cayatano's men had several times crossed by this route to the Pacific. According to their statement, they generally occupied three days in poling up to near the head of the Napipi, and half a day more in walking from that point to the ocean. The whole distance, I was told, however, had been traversed within two and half days by persons in a hurry.

They likewise informed me that gravel showed itself within a day's boating above where we had reached; and that there also the first habitations and cultivation were met with.

When I turned back from ascending the Napipi, (although disappointed,) it was with a determination to revisit it on my return, and make a careful exploration of the entire route. But before completing my survey by way of the Atrato and San Juan, I had crossed to the waters of the Pacific, by three different paths, all of which had been represented as far preferable to that of the Napipi. On one of them especially, it was insisted that no shadow of difficulty presented itself. An eminent ecclesiastic even went so far as to state positively that I should find the point of partition to be but eighteen feet above the waters of the Atrato. Yet, on ascending the tributary so highly recom-

mended, for miles after it had become a roaring brook, I levelled up the aforesaid point of partition for some 500 feet, before putting away my level in despair; and climbed over the remainder in unspeakable disgust.

I had also found that the *canal* of Raspadúra, mentioned by Humboldt as having been made by a curate of Nóvita, and through which loaded canoes were said to have passed from the waters of the San Juan to those of the Atrato, was in reality a *hill*, across which canoes were dragged, as they now are, not only at that point, but at many others in this region. A canoe was so transported at one of the partition points at which I crossed, and at the same time.

There being no roads here, all traveling is done by canoes, which supply the place of the horse with us; with, however, the important difference, that in bad places the traveler carries the canoe, instead of the canoe carrying the traveler.

It may be readily imagined, that after proximity to the scene had so rudely dispelled the charm with which distance and false representation had invested it, my anxiety to explore additional routes was sadly diminished; and I may possibly be excused when having, for the second time, reached the shores of the Pacific by different paths, I preferred to turn my face homeward by way of Panama rather than toil for days up the San Juan, and again embark on the Atrato, to explore, at my own expense, other lines which I had every reason to believe were equally impracticable.

In the absence of positive information respecting the upper portions of the Napipi, and the point of partition near the Pacific, it would be sheer presumption in me to pronounce that route impracticable for a ship-canal. I may, however, be permitted to offer a few humble suggestions respecting the portion which came under my notice:

1st. The soil of which the levees and swamps along the lower portions of the Napipi consist, is open and porous, being composed in great part of beds of dead leaves, logs, and entire trees, the accumulations of ages. No material could be more entirely unfit for forming canal banks, especially for a ship-canal; or offer greater difficulty in the foundations of the locks, and other contingent constructions. All along the Atrato, we noticed the water from the swamps percolating through it, very often in full gushing streams.

2d. The entire region for *at least* twelve (very probably for more than twenty) miles along the stream, is liable to overflow, from one to three or four times a year. At these times it is submerged several feet, and the back-water does not drain off for some weeks, during which periods all work would have to be suspended. How are embankments to be made under these circumstances; or, admitting that they could be commenced, what precautions could be adopted for preventing their destruction by every overflow, while in an unfinished condition?

3d. Throughout the same extent back from the Atrato, more or less rain may be safely calculated on for nearly 300 days in the year, and in every week.

How would embankments of soft marsh-mud, and leaves, stand under the destructive influence of these rains?

Or, from what source could the earth be excavated for making embankments, when water would instantly fill the space from which each spade-full was removed?

4th. Stone and timber fit for construction are entirely wanting, and would have to be brought from considerable distances, at great expense.

5th. Even admitting, for the sake of argument, that laborers *could* be set to work on these marshes, I suspect that very few would live four months; or be able to render efficient service for more than as many weeks.

Now, in order to frame some extremely rude idea of the cost of constructing the Napipi route, let us endeavor to reduce a few of the more important items of expenditure into a somewhat tangible shape.*

Let us assume, for instance, that in a good working day, under all the disadvantages of swamp-miasma and a burning tropical sun, an ordinary laborer could excavate, and with wheelbarrows† form into embankment, three cubic yards of this marsh mud. We will suppose, also, that notwithstanding inundations and rains, he could work three days in the week, and that his cost to the company would be but $2·50 per day for every day, (including his passage to and from home, medical attendance, tools, expenses of pumping, bailing, &c.)

At this rate he would, in one week, excavate nine cubic yards, at an expense of $17·50, or about $2 per cubic yard.

Now, 300,000 cubic yards per mile is a moderate assumption for a ship canal, and gives us $600,000 per mile for excavation alone.

To this we may add, for locks, for coffer-dams, for the exorbitant salaries necessary to induce officers to live (or, rather, to die) in these infernal regions, for a line of steamers and sailing vessels, for buildings, roads, &c., fully $200,000 more per mile, making a total of $800,000 per mile.

Let us suppose the entire distance to be but thirty miles, and that the point of partition is a ridge two miles across, and rising 300 feet in the centre; also, that instead of making use of the Napipi, a straight line be cut, which I think would be the preferable plan, as it would shorten the canal to perhaps one-half its river length, and cost less.

Then we shall have, say—

Twenty miles, constructed through the Napipi swamps, at $800,000, - - - - - - - - - -	$16,000,000
Two miles of deep cutting, averaging 150 feet in depth, and containing 16,000,000 of cubic yards, at 50 cents,	8,000,000
Carried forward, - - - -	24,000,000

* The prices which I have assumed will, doubtless, appear exorbitant to most of my readers. But, in vindication of them, I will merely remark, that I was Chief Engineer of the Panama Railroad, for the first year of commencing its construction, and from the experience acquired there, I am perfectly convinced that they are *entirely too moderate for the locality of the Napipi route.* The Panama Railroad could have been constructed in the United States for $25,000 per mile; its actual cost will not fall much, if any, short of $125,000 per mile. The disproportion would be *much* greater on the Napipi canal.

My ideas respecting the probable mortality of the employees are based upon the same experience on the swamp portion of the Panama Road, and are by no means overwrought.

† Horses and carts could not be employed.

Brought forward, - - -	$24,000,000
Eight miles in better soil, and less unhealthy locality, at, say, $200,000, - - - - - - - -	1,600,000
Deepening the Atrato thirty-nine miles, to the Vigía Curbaradór, so as to secure a depth of twenty-five feet of channel-way, removing, say, 200,000 cubic yards per mile, on an average, at $1 per yard, including raising it over the levees and depositing it on their inland slopes,	7,800,000
Stopping up the upper end of Caño Tadia, so as to force its waters through the channel of the main river, -	1,000,000
Improvements at Boca Urabá, - - - - - -	1,000,000
	$35,400,000
Add, roughly, for interest on gradual expenditures during fifteen years of construction, - - - - -	15,000,000
	$50,400,000

By this supposititious process, therefore, we arrive at the sum of fifty millions of dollars for the construction of the canal, a sum which I regard, however, as *totally inadequate for the purpose.*

Whether water could be obtained for filling it, even if it should be constructed, I cannot pretend to say, but regard it as extremely doubtful.

Were it as easy a matter to *raise* a few hundred millions of dollars as it is to *talk* about them, there would be no difficulty about water, inasmuch as that of the Atrato itself might be used for locking down into the Pacific.

I have coasted and boated along both sides of the region comprised between the Pacific Ocean, from Panama to Buena Ventura, on one side, and the Caribbean Sea, the Atrato, and the San Juan, on the other side; and have crossed it both at the site of the Panama Railroad, and at three other points more to the South. From all I could see, combined with all I have read on the subject, *I cannot entertain the slightest hope that a ship-canal will ever be found practicable across any part of it.* When I employ the word *practicable* it is meant in a practical sense.

From careful levellings (with a spirit level) at several points, I am confident that the fall of the Atrato, from the mouth of Napipi to Boca Coqúito, does not exceed 28 feet, or an average of about 2½ inches to a mile.

The River Opogadó enters the Atrato from the West, thirteen miles below the Napipi. I ascended it for four miles. Its width at the mouth is 120 feet; at four miles above, it is 100 feet. Depth near the mouth, two fathoms, which it retains for more than two miles, gradually shoaling afterwards to eight feet at the end of the four miles. It is very crooked, and encumbered by sunken trees. The bottom is of mud, so stickey that we could scarcely detach the heavy lead of our sounding line. Current near the mouth, 1½ mile per hour; at four miles up, two miles.

To be Continued.

On Railway Turntables. By Samuel Lloyd, Jun.*

[Paper read at the Institution of Mechanical Engineers.]

In the construction of turntables, three leading principles have been followed; either the bearing has been on the centre only, with no bearings at the circumference, or with bearings at the circumference and none at the centre; or a combination of these two modes has been adopted by allowing the weight to rest in part upon the centre, and in part upon the bearings or rollers at the circumference; this last construction has been most frequently adopted. Most of the turntables first laid down on railways were made to rest on fixed-rollers, for the sake of economy; but although fixed-roller turntables are the cheapest kind in first cost, and were much used on the first railways made, live-roller tables have been generally adopted latterly, from the greater ease with which they turn;—as in the fixed-roller turntable the weight bears on the axle of the roller, producing rubbing friction, but in the live-roller table it bears upon the circumference of the roller, producing only a rolling action without any rubbing friction except in the guiding ring. Some fixed-roller turntables have however of late been constructed with much larger rollers than those formerly used, which has the effect of perceptibly lessening the friction; but these tables seldom continue long in good working order, in consequence of the rollers *indenting* the top table. This is an objection to which all roller turntables are subject, but those with fixed rollers most especially, from the top table always resting upon the rollers in these in the same position, thus receiving the pressure always on the same points; and as the amount of surface in contact between them is very small (the whole amount of surface in contact between the surface of the rollers and the top table being not more than three square inches, if so much), the rollers soon wound the under surface of the top table, so that the latter becomes indented over every roller. As soon as this takes place, considerably more power has to be exerted to turn carriages upon them, as the resistance to be overcome is greatly increased by the whole weight having to by lifted out of each of the hollows formed from the above cause.

But in addition to the increase of friction occasioned by these indentations, they cause also great unsteadiness, making the table rock, and thus clatter and hammer against the rollers as each pair of wheels passes on and off its two opposite sides. This deteriorating action goes on to a greater or less extent in almost all roller tables, often occasioning the top to break, if it is not very strongly made; this rocking is often greatly increased, and occasionally entirely originates, from the centre being too tightly screwed down, so as to take the weight entirely off the rollers on one side of the table.

This defect has led to the construction of turntables with a centre pin that acts merely as a centre guide, without taking any weight. Turntables of this class, if made with radiating rollers, have the advantage of remaining very solid for a time after they are put in, but frequently this is not of long continuance, for all roller turntables are unsteady, if the rollers are not *all* correctly turned to the same diameter, and cottered or

*From the Civil Engineer and Architect's Journal, February, 1854.

screwed up exactly to the same distance from the centre; each roller being a portion of a cone, its outside diameter is greater than its inside, and if either of the rollers is screwed up too tightly, the table rides on it. This is sometimes occasioned after a few months' wear, by the pressure of the table top continually exerting a force tending to drive the rollers upon which it rests outwards, which is sure to be the effect if either of the nuts that screw them becomes slack. This pressure tending to force the rollers off the roller path, causes considerable friction against the guide ring at the boss of every roller, and is one cause of the heaviness with which even live-roller turntables work, causing railway laborers in goods stations, whenever they have the chance, to wrench them round by horse power.

In an improved construction of roller turntables extensively adopted, the weight of the table top is nearly counterbalanced by a weighted lever which constantly tends to lift the centre pin without actually doing so, making the table much easier to turn, by diminishing proportionately the pressure on the rollers; the rollers also are not fixed as in common turntables, but in an inclined position, with their upper surfaces level, for the purpose of preventing the level of the table top from being disturbed by the surge of carriages passing over. In some turntables the rollers have been made with rounded edges and level rolling paths, with the view of lessening the friction of turning, and increasing the steadiness of the table by resting it on a plane instead of a cone; but these rollers have not been found to be durable, and the roller path becomes worn hollow by them. A more successful plan for diminishing the friction has been the use of spherical balls instead of rollers, traveling round in a live ring, to prevent the balls from rolling off, but allowing them room to shift their position on the roller path as they move round, which prevents them from wearing the roller path into grooves; and as the balls travel in a circle, sometimes in one direction and sometimes in the contrary direction, they continually present a fresh portion of their surface for the bearing, which preserves them from being worn unequally.

There is one objection to these tables, but which applies still more strongly to roller turntables—namely, the extreme difficulty of turning them in frosty weather, when the dirt on the rollers and roller paths becomes frozen; horse power is then often required to stir them, or a fire has to be lighted to thaw the congealed mud collected on them.

Centre-bearing turntables are particularly free from this objection, and also from the one before referred to—namely, the bearing surface becoming indented, from the small extent of surface in contact with the rollers.

They also, as usually constructed, have most of them two defects—namely, great extra cost of foundations, and unsteadiness and liability to deflect; the last being the most serious defect, which renders them objectionable for any situation where much traffic is likely to pass over them. Their deflexion upon trains passing over them being caused by the whole of the weight of each carriage acting as a great leverage to strain the working parts of the table while running on and off.

The *unsteadiness* of the centre-bearing turntables described above may be considered as the principal cause of their disuse, notwithstanding

their superiority over roller tables in ease of turning; another cause being the expense and depth of the foundations requisite.

Figs. 1 and 2 show an improved mode of constructing turntables, by which the result is obtained of supporting the table top by its circumference when out of use, and upon its centre when in use. The action of the lever B, B, in this table, is to raise the table sufficiently to disengage the blocks H, H. When the table is not in use the lever is in the position showen at B, B, but as soon as it is necessary to turn a carriage, the table top is eased off the four blocks H, H, at the circumference, under the main-line rails, by being raised from $\frac{1}{4}$-inch to $\frac{3}{8}$-inch by the action of the knuckle joint lever F; by this time the stud I, which is fixed upon the long lever B, B, having traversed to the end of the slot in which it works, carries the rod K, with it; thus withdrawing the four blocks H, H, from under the outer ring E, E. The long lever is now at the position

Fig. 1.

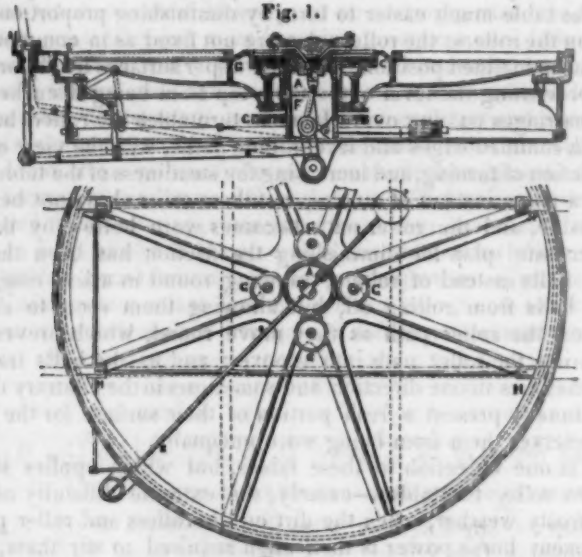


Fig. 2.

shown in the drawing, or at the bottom of its stroke; the centre joint of the knuckle joint lever F, has now passed from one side of the centre line of the table to the other. The table top is exactly at the same level when the long lever is at the bottom of its throw as when it is at its top; the difference being that when the long lever is up as shown by the dotted lines D, D, the table top is supported entirely at its circumference on the four blocks, which may be made of any convenient size; and while it is down the weight is on the centre pin C, when carriages may be turned with ease and rapidity. By means of the stud I, traversing the slot in the rod K, during the first part of the motion, the table top is eased off the bearing on the blocks H, H, before the rod K is set in motion to withdraw the blocks; and by the same means, in lowering the

table, time is allowed for the blocks to be pushed home before the table top is lowered upon them, so that the blocks are relieved from the weight whilst they are being moved. Fig. 2 is a plan of this turntable, showing the position of the long lever B, B, and the horizontal rollers G, G, that work around the centre pillar A. At the end of the lever L, a weight is fixed to balance the weight of the table top to within a few cwts.; the balance weight not being made heavy enough to raise the table top without the exertion of a slight pressure on the handle M. Other modifications of this improved table might be described, but as the principle in them all is the same, viz., to carry the weight on the centre pin when the table is being used, and upon the circumference when not in use, it is not necessary in the present paper to do so.

This mode of construction insures a *solid turntable*, one very *easy to turn*, and a very *durable* one; the working parts do not get deteriorated by the passing of trains, and are so placed that dirt cannot collect upon them; the extent of bearing surface at the circumference is greatly increased, and prevented from becoming indented as in roller tables; a smooth and easy motion is obtained by turning entirely upon the centre, as no inequality of bearing surface has to be overcome; also, less oil is consumed for the centre bearing than for rollers, and the working parts are more easily oiled. In roller tables an increased load increases greatly the resistance to turning, and after some years' wear they work more heavily; but in centre bearing tables much less difference is experienced. Also, the cost of foundation, instead of being more, is rather less than that required for roller turntables with a live ring and rollers, as a continuous ring of masonry is not required round the circumference, but only six or eight blocks of stone, one under each arm of the centre pillar, in addition to the centre stone, which is required in both descriptions of turntables.

Annual Report of the Engineer of the Philadelphia Gas Works.

TO THE TRUSTEES OF THE PHILADELPHIA GAS WORKS:

Gentlemen:—The Engineer respectfully presents to the Trustees of the Philadelphia Gas Works his Eighteenth Annual Report, detailing the operations of the Works for the year 1853.

In the quantity of Gas manufactured, there is an increase of thirty-three million cubic feet.

Considerable difficulty has been experienced in obtaining a sufficient supply of coals, in consequence of which it has been found necessary to buy varieties of inferior productiveness at high prices, whereby the yield of gas to the pound of coal will be diminished, and its cost much increased. In other respects the results obtained are as favorable as usual.

There has been manufactured during the year, two hundred and forty-nine million four hundred and twenty-seven thousand cubic feet of gas; making an aggregate production from the works of sixteen hundred and sixty-four million three hundred and forty-four thousand cubic feet.

The product for the year has been distributed in the following proportions to the different municipal sections, supplied from our Works.

	Cubic feet.
District of Southwark,	10,458,200
Do Moyamensing,	5,810,700
Do West Philadelphia,	2,765,720
City, including what is used at the Works and offices, and loss by leakage, and opening of mains for connexions and service pipes,	230,392,380
	249,427,090

The maximum product of gas in twenty-four hours, was one million one hundred and thirty-seven thousand cubic feet.

The maximum consumption, one million three hundred and eighteen thousand feet.

For the manufacture of gas, the materials used in the year, are as shown in the following statement:

Coal in store January 1st, 1853,	454,101	Bushels.
" bought in 1853,	635,991	"
	1,090,092	"
Coal carbonized in 1853,	779,628	"
" in store January 1st, 1854,	310,464	"
	1,090,092	"
Coke on hand January 1st, 1853,	123,000	"
" made in 1853,	895,434	"
	1,018,434	"
Coke used under retorts,	475,867	"
" " at New Works,	16,839	"
" " in Office and Yard,	7,140	"
" sold,	513,588	"
Stock of coal on hand January 1, 1854,	5,000	"
	1,018,434	"
Rosin used,	134,327	Pounds.
Lime used in purifiers,	60,156	Bushels.

In the department of distribution, the additions to the service pipes and meters, have again surpassed those of any former year, and the increase in number of lights is also greater than has been experienced. The main pipes laid in streets have been as follows: two inch pipes, seven thousand one hundred and fifty-two feet; three inch, three thousand seven hundred and forty-four feet; four inch, three thousand seven hundred and eighty feet; six inch, four hundred and fourteen feet; sixteen inch, seven hundred and twenty feet; twenty inch, seven thousand two hundred and fifty-seven feet; total, twenty-three thousand and sixty-seven feet. The entire length of street gas mains is now six hundred and twenty-seven thousand two hundred and thirty-three feet, or one hundred and eighteen and three-quarter miles.

There have been one thousand three hundred and sixty-four service

pipes laid in new places, and the same number of new meters set; which, added to those before in use, make an aggregate of thirteen thousand and seventy-four services and meters.

Applications for gas have been registered to the number of three thousand two hundred and eighty, and the removals, and discontinuances are one thousand nine hundred and fifty-four; leaving one thousand three hundred and twenty-six as the increase of consumers, and making the whole number of consumers at this time, twelve thousand nine hundred and eighty-nine. The lights added are twenty-five thousand four hundred and thirty-two private, and eighty-eight public; also, twenty-three in Independence Square. The Districts of Southwark and Moyamensing, and West Philadelphia, report fifteen thousand six hundred and twenty-nine private, and four hundred and eighty-five public lights; which make a grand total of two hundred thousand eight hundred and forty-five supplied from our Works.

In one of the Western Public Squares, main pipes have been laid down by the direction of the Committee on City Property, but the gas has not yet been introduced.

By reason of the great increase of street mains and service pipes and meters the expenditures in this department have outrun the provisions heretofore made for it, to an extent that makes some further authoritative action a matter of imperative necessity. When in the year 1844 the Contingent Fund was devoted to the purpose of defraying the cost of the extensions of distribution, the number of services and meters required to meet the demands of new customers had averaged in the previous three or four years not quite three hundred and fifty per annum, and therefore the sum of thirty thousand dollars a year, to which the Contingent Fund was restricted, was deemed sufficient for this object. Since that period the annual applications for gas have become much more numerous, and particularly so since the recent large extension of the main pipes into all quarters of the City for the purpose of affording to every section the advantages of street lighting. The growth in this respect has exceeded all anticipations formed in regard to it, so that instead of the average of three hundred and fifty a year, on which the limitation of the Contingent Fund was based, the new services and meters furnished have increased to the large number of one thousand three hundred and sixty-four in the last year, and have averaged nearly one thousand two hundred and eighty the last three years. As a necessary consequence, the expenditures of this department have grown from the original estimate of thirty thousand dollars a year to over seventy-five thousand; and thus not only absorbed the whole of its own proper Fund, but have also encroached largely upon the resources designed for the enlargement of the Works and for Working Capital. All that can be derived from these sources is now exhausted, and the increase of street mains and service pipes and meters must therefore cease until funds are provided for their cost.

At the new Works in Passyunk, the principal structures are all roofed in and nearly completed; and as much progress has been made in fitting up the apparatus and its connexions as circumstances allowed. Much delay has arisen in the prosecution of this work from the unusual scarcity of

skilled laborers; and the difficulty from this cause was enhanced by the want of suitable dwellings for the accommodation of the workmen; in consequence of which it has been impossible to keep the desired force on the work; for in a season of unusually active employment, many workmen refuse to engage at a place so far distant from their residence; and it was found that skilful mechanics could be kept steadily employed, only by providing them with means of conveyance to and from their work, whereby much expense has been imposed on the Contractors and on the Gas Works.

The same difficulty of accommodations made it expedient to postpone the commencement of Gas Making Operations to the latest possible period: for the accomplishment of which it has been necessary to keep the Apparatus at the old Works in the highest state of efficiency attainable by the most vigilant daily inspection, and the prompt renewal of the parts exposed to destructive agencies, without waiting for the degree of dilapidation ordinarily admissible. By these means the supply of gas has been thus far maintained without recourse to the New Works, and it is believed it may be carried through the present winter unless some unforeseen disaster should occur to diminish materially their effective condition.

Should the question of the erection of dwelling-houses for the workmen be left in its present unsettled state, in which no authority is granted to the Trustees and no incentive is offered to individuals to undertake their construction, very serious inconvenience and much useless expense will be the probable result.

Very respectfully submitted, by

JOHN C. CRESSON, *Engineer.*

Philadelphia Gas Works, January 13th, 1854.

AMERICAN PATENTS.

List of American Patents which issued from February 7th, 1854, to February 28th, 1854, (inclusive,) with Exemplifications by CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

FEBRUARY 7.

1. For *Improvements in Rotary Engines;* Ebenezer Barrows, City of New York; patented in England, July 3, 1851.

Claim.—"I do not claim the sliding pistons, nor an abutment or stop in the steam channel or passage around the interior of the cylinder, irrespective of the manner in which they are arranged, and in which they operate; but I claim, 1st, the revolving steam wheel, having projecting rims or flanches, revolving within the interior of a stationary cylinder, in which there are two or more fixed abutments or stops, which fit steam-tight, so as to close and divide the annular space between the cylinder and wheel, into two or more steam chambers; the said steam wheel having four or more pistons whose operation is controlled by a stationary curved groove or way in each cylinder head, so as to be alternately acted upon by the steam in the cylinder, and down within the wheel, so as to pass and clear the abutments or stops, substantially in the manner shown. 2d, The six way cocks or steam heads, having each a steam passage leading to its plug seat, two steam passages leading from the plug seat to opposite chambers of the cylinder, two exhaust passages leading from opposite chambers of the cylinder back to the plug seat, and one

leading from the plug seat to the exhaust pipe, their cock plugs being provided with suitable openings and passages to make communication to or from the steam and exhaust pipes to either division of the cylinder, or to close both, substantially as explained. 3d, The mode of uniting the face and side packing pieces of the pistons and abutments, so as to make them steam-tight at their corners by dove-tailing them, as specified. I further claim making the steam cylinder within and a part of the piston wheel, the stationary rim forming the outer side of said cylinder, so that three sides of the said cylinder shall revolve with the pistons, substantially as set forth."

2. For an *Improvement in Dental Chairs;* A. Merritt Asay, Philadelphia, Pa.

Claim.—"What I claim is, moving the chair seat vertically, by means of screw, wheels, shafts, rack and arms, substantially as set forth."

3. For an *Improvement in Turning Lathes;* Edward Bancroft and William Sellers, Philadelphia, Pennsylvania.

Claim.—"What we claim is, the method of varying the motions of the mandrel, and screws or leader, by means of the two series of wheels, each series consisting of wheels of different diameters, and all the wheels of one series being connected and turning together, and imparting motion to all the wheels of the second series, with different degrees of velocity, substantially as described, when this is combined with the method of locking any one of the wheels of the second series with the shaft of the screw or leader, by having the wheels on separate sleeve arbors, fitted to turn on each other, and adapted to receive a locking pin or bolt, fitted to holes in a plate attached to the shaft of the screw, substantially as specified, or any arrangement effecting the same end by means substantially the same. We also claim the manner of supporting and sustaining the screw or leader by combining therewith, a trough, substantially as specified, having the outer end of the said screw or leader without a journal, as set forth."

4. For an *Improvement in Machines for Ruling Paper;* John and William McAdams, Boston, Massachusetts.

Claim.—"What we claim is, 1st, A machine for ruling paper, in which both the horizontal and vertical lines of the sheet are ruled in passing once through the machine, by any arrangement of devices which carries the sheet, after one set of lines is ruled, in a direction at right angles to its first course, to another set of pens, which rule the sheet across the lines first made. 2d, We claim changing the direction of the movement of the sheet after passing from the first set of pens, by means of the traveling band and revolving drums, as described. 3d, We claim lifting the pens so as to leave a heading to the sheet, by means of the roller with its movable tongue and cam projection, acted upon by the edge of the paper and the motion of the feed roll, so as to lift an adjustable arm connected to the pen holder, substantially as described. 4th, We claim forming grooves in the feed rolls so that the pens may rest over these grooves, and not upon the rolls between the passage of the different sheets, as set forth. 5th, We claim guiding the sheet straight to the second set of pens, after the direction of its movement is changed, by means of the converging bands, which carry the edge of the sheet against a proper guide, or against the side frame work of the machine, as specified. 6th, We claim forming the last roll which carries the sheet after it is ruled, to the receiver of a polygonal or angular shape, so that its revolution may give a vibratory motion to the sheet, for the purpose specified."

5. For an *Improvement in Machines for Making Nuts;* Jacob Reese, Sharon, Penna.

Claim.—"What I claim is, 1st, The use of the trough of cold water, in combination with the rotating die box, for the purpose of cooling each die or mould after it has discharged its nut, and preventing the water from coming in contact with other parts of the machine, or with the nuts which are made in it. 2d, I do not claim the rotating of the mould box, but I do claim the use of the guide head, constructed as described, in combination with the lever and guide, for the purpose of communicating to the rotating mould box the peculiar motion required, consisting of a succession of sudden, yet steady quarter revolutions, each followed by a pause or rest, during which the mould box is held firmly in its place, in the manner described."

6. For an *Improvement in Winnowers;* Michael Shimer, Union Township, Penna.

Claim.—"I do not claim the adjustable side alone; but what I do claim is, the movable side, in combination with the inclined screen, said combination subserving three purposes: 1st, For preventing the grain from passing over the edge of the screen until it has been

properly presented to the blast or draft. 2d, For partially cutting off the draft, as the state of the grain may require. 3d, For expanding the draft of the blast as it ascends the trunk, so as to weaken the force of the blast, in such a manner that the pure grain will not be carried over into the horizontal part of the trunk. 2d, I claim the square rubber, in combination with the circular flanch formed on its lower extremity, as described, for the purpose of mashing or grinding all impurities softer than the wheat, and also for preventing the grain from passing out of the bottom of the hopper before it has been thoroughly pulverized, as described."

7. For an *Improvement in Winnowers;* Josiah Turner and W. C. Sturoe, Sunapee, New Hampshire.

Claim.—"We do not claim the toothed cylinder or thresher, with its corresponding toothed concave; nor do we claim either of the devices described, separately; but we claim the combination of an oscillating cradle, of slanting slat or blind work, as set forth, with the two blowers and the fender, substantially in the manner and for the purpose set forth."

8. For an *Improvement in the Mode of Making Battery Connexion with an Electro-Magnetic Coil on the Traveling Carriage of a Telegraphic Register;* John M. Batchelder, Cambridge, and M. G. Farmer, Salem, Massachusetts.

Claim.—"We claim the combination of the system of progressive levers with the battery wires, the base board, and movable platform, so as to operate substantially as specified, and for the purpose set forth."

9. For an *Improved Machine for Polishing Plough Handles and other Articles;* Thos. Blanchard, Boston, Massachusetts.

Claim.—"I do not claim the invention of an endless polishing or smoothing belt; but what I do claim is, the mode of applying and operating said belt with respect to the article to be smoothed or polished, the same consisting in not only making the said belt to traverse or run on sustaining pulleys, or their equivalents, but at the same time to rotate such belt and sustaining contrivances in such manner around the article to be smoothed or polished, as to cause the belt, while in motion on its rollers, to run in contact with and around the surface or article to be reduced, smoothed, or polished. I also claim the combination of the feeding carriage, its guides, and the guide rollers, or the mechanical equivalents therefor, with the endless polishing belt provided with machinery for imparting to it its compound motion or movement in two directions, as specified."

10. For an *Improvement in Machines for Cleaning and Assorting Bristles;* George Edward Burt, Assignor to self and David C. Butterfield, Westford, Massachusetts.

Claim.—"What I claim is, the combination of machinery for combing or straightening the bristles, and machinery for separating or assorting them, as specified. I claim the combination of the two movable combs or rakes, and the two lifter wheels, and then carrying endless belts, and so arranged as described, the whole being for the purpose of first holding the mass of the bristles by one part or portion of it, and lifting and combing the remainder of it, and subsequently seizing and lifting it by such combed part or portion, and combing the part previously seized, all as specified. And, in combination with the machinery for combing or straightening the bristles, and machinery for assorting or separating them, I claim the endless guide belt, the spring band, and rapping apparatus or hammer, as applied and made to operate substantially in manner as specified. I do not claim the combination of an endless platform, roller, and a series of pressure rollers, as employed in the machine of Lorenzo D. Grosvenor; but what I do claim is the combination and arrangement of the two endless brush belts, and two series of draft rollers, and their two sets of endless bands, as made to operate together, and assort the bristles, substantially as specified. I claim the combination of the combs and their grooves with the delivery rollers, so as to operate substantially as specified."

11. For an *Improvement in Bit or Drill Holders;* Dexter H. Chamberlain, Boston, Mass.

Claim.—"I am aware that a hand drill has been constructed so as to have its drill shaft supported in a stock, and rotated by means of two beveled gears, one of them being fastened on the top of the drill, while the other was affixed on a separate shaft, disposed at right angles with the drill shaft, and having the crank applied so as to enable a person to rotate it, and thereby put the drill shaft in rotation; I therefore lay no claim to such a device. In the said drill stock, the crank of it is made to rotate in a plane parallel to the axis of the drill shaft; the consequence is, that during a rotation of the crank, there is an

uneven pressure exerted on the drill, the said pressure being increased at one moment, and diminished at another, and in the direction of the axis of the drill. A steady pressure on the drill, longitudinally as well as laterally, is desirable, particularly when a small drill is used, as without it the drill is not only liable to be broken or injured, but to be made to deviate in its desired course in passing through anything. The complication of the construction of the beveled gear bit stock, and the disadvantages incident to it while in use, render it an instrument of little value and utility. Neither do I claim making the tool stock and the bell crank in one piece of metal, so that their rotations may be equal and simultaneous; but what I do claim is, the arrangement of the bell crank separate from and so as to play or rotate within the tool shaft stock, substantially as specified, the said bell crank having a spur gear to work into a pinion fixed into the end of the tool shaft, and to impart to said tool shaft an accelerated motion, essentially as specified."

12. For an *Improvement in Tool Holders;* Dexter H. Chamberlain, Boston, Mass.

Claim.—"I do not claim a split or jaw socket having a screw and screw nut applied to it for the closing its jaws upon the shank of an awl or tool inserted between them; but what I do claim is, my improved method of arranging, constructing, and applying together the jaws and confining screws, the same consisting in making the jaws separate from the screw shank, (on which the screw is cut,) and in other respects substantially as described, and not only providing the screw nut with a closing concavity or socket, but the screw shank with a closing socket for the jaws to rest in, the whole being so that when the screw nut is screwed down upon the jaws, the combined action of the jaws and the screw nut shall operate to simultaneously close the jaws at their upper and lower ends, as specified."

13. For an *Improvement in the Manufacture of Tin Foil or Sheets;* John J. Crooke, City of New York.

"My invention consists in such improvement in the manufacture of tin foils or sheets, that by it I accomplish the reduction of the cost, though retaining those qualities which are essential to the purposes for which such foil or metal is required. This I effect by combining the baser and cheaper metal, lead, with the tin, not, however, in the form of an alloy, or mixture, but so that each metal will be kept perfectly distinct, the tin or superior metal being only exposed, while the lead or inferior metal is encased within."

Claim.—"What I claim is, the new article of manufacture described; that is to say, sheets or foils composed of tin and lead, formed in separate strata, but so that the exposed or external surface shall be pure tin only, for the purposes and substantially in the manner set forth."

14. For an *Improvement in Blocks for Horse Collars;* Lewis S. Davis, New Paris, O.

Claim.—"I do not claim the construction of a horse collar block in expanding sections; but I do claim the four parted collar block, of which the front pair of sections are hinged together at the gullet, and the back pair at the neck of the block, as described, the same being combined with a stationary bolt, placed at the intersection of the partings, the said bolt serving to unite the base and cap, and also forming a fixed bearing for the right and left hand screw, which, in conjunction with the pins on the block and the diverging grooves in the base and cap, effect the prolongation and proportional lateral expansion of the block or devices, substantially equivalent."

15. For an *Improvement in Omnibus Registers;* F. O. Deschamps, Philada., Pa.

Claim.—"What I claim is, 1st, Attaching the secret slide to the bolt of a lock, substantially as described, so that it can only be moved to expose or conceal the numerals on the dials, by a key which properly fits the lock. 2d, Combining the secret slide, with a stop bar, substantially as described, so that both move together in such a manner that when the apparatus is left free to work by the stop, the numerals on the concealed dials are not exposed, and when the numerals are exposed to view, the apparatus is made inoperative by the stop."

16. For an *Improvement in Tool Holders;* Elias Hall, Rutland, Vermont.

"My invention consists in adapting to a common handle, a shank, so contrived that any bit, or other tool of the kind, as a jointed file, screw driver, and the like, may be inserted with facility, and held perfectly firm while in use, and readily removed when another is to be employed."

Claim.—"I am aware that instruments somewhat similar have been used, and that this nearly resembles a bit stock; but in their construction, and especially in the application

of the spring, my invention is greatly superior; no other instrument of the kind has before been constructed so that it could be seen where the notch should be made upon the tool to receive the tooth of the spring; hence it has been found difficult to have every tool used in such an instrument firmly held, and it is only effected by repeated experiments and trials in making the notch; while in the instrument described, it can be seen at once exactly where the notch should be made so as to retain the tool when steadily and firmly held by the socket; besides, I am not aware that any such contrivance has ever been employed in an instrument to be held and used in one hand, or with a common handle. What I claim is, having a flat spring catch inserted in the side of the stock or handle, with an opening through the stock or handle, in a line with the catch of the spring, by which you are enabled to see and mark on the shank of the tool held, the point touched by the catch of the spring when the shank is pressed home in the socket, and thus readily mark the recess or notch in the shank."

17. For an *Improvement in Ploughs;* John S. Neall, Manchester, Pennsylvania.

"My invention consists in fixing the mould boards of either single or double ploughs on hinges, so as to be capable of being adjusted to any required width of furrow or crop to be cultivated, in so attaching the beam to the body of the plough by means of screw bolts that the point of the beam can be raised or lowered at pleasure, with great precision, so as to cut any required depth of furrow, in the manner of giving a nice lateral adjustment to the end of the beam by means of a set screw, so as to regulate the angle of the plough with the line of draft, in such way as to give land to the plough, or take it from it, and also in the mode of raising or lowering the points of draft of the plough, without altering the position of the beam."

Claim.—"What I claim is, the hinges, constructed in such a way that the edge of the front part of the mould board may lap over the edge of the back part or wing of the mould board, to prevent clogging."

18. For an *Improvement in Metallic Hubs;* J. B. Hayden, Easton, New York.

Claim.—"I do not claim the flanches, either with or without radial slots or recesses for the purpose of admitting the spokes; but what I do claim is, the disk, in combination with the recesses or 'saw cuts,' formed in the end of the spoke, into which disk is fitted, and acts to secure said spokes in a permanent position, and effectually prevent them from working in the hub, as described."

19. For an *Improved Machine for Dressing Spokes;* Ansel Merrell, New Bedford, Assignor to Ansel Merrell and John M. Irvine, Sharon, Pennsylvania.

Claim.—"What I claim is, the combination of the cam lever, having a screw thread thereon, with the adjustable dogs and supports, as herein set forth, whereby the rough stick or block may be held firmly at any required angle to the carriage, and at variable distance below the knives, in order that it may dress spokes of variable taper, and of different thicknesses."

20. For an *Improved Daguerreotype Plate Holder;* Reuben Knecht, Easton, Pa.

"The nature of my invention consists in providing two corners of the holder with two movable arms, which are projected by an eccentric wheel, turned by a swivel, and providing the holder with an oblong aperture for the shaft of the eccentric wheel to move to one side or the other, according as one or the other of the arms require a further projection."

Claim.—"What I claim is, the application of the eccentric wheel to the projection of the arms, or, which is effected by turning the swivel, which is firmly attached to the wheel aforesaid, in the direction of arrow 2, and the application of the oblong aperture to the projection of either arm, according as one or the other of the arms require a further projection, for the purposes described."

21. For an *Improvement in Sewing Birds;* Julius E. Merriman, Meriden, Conn.

Claim.—"What I claim is, employing, in connexion with a sewing bird, a spring tape measure, arranged in a case placed directly under the belly of the bird; the said case being so situated that it may have, if desired, a handsome pin or needle cushion placed on its top; this arrangement rendering the sewing bird capable of measuring as well as holding the cloth, while the sewing or measuring operations are being performed, and it also makes it more convenient for use, and ornamental in its design, as set forth."

22. For an *Improvement in Lime Kilns;* Clark D. Page, Rochester, New York.

Claim.—"What I claim is, the form, substantially as described, of the stack or cupola,

in combination with the arrangement of flues from the fire chambers for the introduction of the products of combustion at the lower end, substantially as specified, to insure the burning of the central part of the charge, as specified. I also claim cooling the calcined lime preparatory to drawing it out and exposing it to the atmosphere, by causing a current of cold air to pass through the saddle, or its equivalent, placed at the bottom of the stack, and on to which the calcined lime descends, as described."

23. For an *Improvement in Portable Door Locks;* Joseph W. Webb, Washington, District of Columbia.

Claim.—"What I claim is, the claws, in combination with the bar and thumb piece, constructed in the manner and for the purpose described."

24. For an *Improvement in Planing Machines;* James A. Woodbury, Winchester, Massachusetts.

Claim.—"What I claim is, 1st, The combination of the rotary disk cutter with the pressers and bed, substantially in the manner and for the purposes described. 2d, The combination of the bramah wheel, so called, with the rotating disk cutter and its accessories, for the purpose of planing, substantially as set forth."

FEBRUARY 14.

25. For an *Improvement in Picking and Cleaning Flax;* A. H. Caryl, Sandusky City, Ohio.

Claim.—"Although I have described the method of producing the currents of air required, I do not wish to be understood as limiting myself thereto, as the required currents may be obtained by other and equivalent means. Nor do I wish to limit myself to the special mode of construction of the other parts, so long as the same ends are obtained by equivalent means, in the combination specified. What I claim is, the employment of a picker having teeth hooked in the direction of the rotation, and arranged on separate bars, so connected with the shaft as to leave open spaces for the free passage of foreign substance, substantially as specified, when this is combined with hooked teeth, in a series of bars above, with open spaces between them, substantially as specified, with a current or currents of air, substantially as specified, to act on the fibres during the operation of combing, and with the rotating brush acting on the picker teeth, substantially as specified."

26. For an *Improved Arrangement of Vertical Tube Feed Water Heaters in Locomotive Smoke Stacks;* Matthias W. Baldwin and David Clark, Philadelphia, Pa.

Claim.—"We do not claim the employment of a heater for feed water, containing vertical tubular passages; but what we do claim is, the arrangement of the exhaust pipes, with a vertical central passage of large section and surrounding passages of smaller section, said central pipe and smaller passages being open above and below, in the manner and for the purpose substantially as described."

27. For an *Improvement in Machines for Cleaning Wool;* Lewis T. Chichester, Brooklyn, N. Y.

"The nature of my invention consists in making lateral, inclined, or curved slots, terminating in openings, circular or otherwise, smaller than the burrs, &c., in the edges of the ribs, so that the fibres which are caught by the picker teeth to be drawn through shall be guided by the lateral slots into the circular openings, and thus avoid cutting or chafing them, as would be the case if they were drawn through between the ribs and the teeth. Also, in making the said slots at or near that part of the length of the ribs where the picker teeth begin to leave the line of the ribs, and thus avoid all tendency to chafe and cut the fibres between the ribs and teeth. My invention also consists in uniting the contiguous barbs or points of any two ribs formed by the cutting of the lateral inclined slots, and extending them below the line of motion of the points of the picker teeth, to insure the carrying of all the fibres which are caught by the picker teeth into the lateral slots. And finally, in the employment of card or equivalent teeth between the rows of picker teeth, to catch and draw through such of the fibres as may have escaped from the picker teeth after being drawn into the lateral slots."

Claim.—"And although I have described and represented the form of the ribs, barbs, and picker teeth, I do not limit myself thereto, as this may be greatly varied without changing the principle or character of my invention. Nor do I limit myself to the use of a rotating brush for presenting or feeding the fibres to the ribs and picker teeth, as this makes no part of my invention, and can be done by other means. Nor do I limit myself

to the form, number, or manner of making or operating the teeth, as these may also be greatly varied and yet effect the same purpose; but what I do claim is, making the edges of the ribs, when combined with picker teeth for catching and drawing the fibres through, substantially as specified, with lateral, inclined or curved slots, terminating in an enlargement or hole to receive the fibres and guide them away laterally from the picker teeth, to prevent them from being chafed or cut between the teeth and ribs, substantially as specified. Also, making the lateral slots in the edges of the ribs, substantially as specified, and in combination with the picker teeth at or near the portion of the length of the ribs where the fibres begin to be drawn through, substantially as specified, whereby I effectually avoid the cutting of the fibres. And I also claim uniting the contiguous barbs of any two ribs, and extending them down below the points of the picker teeth, substantially as specified, to prevent fibres from passing without being picked or drawn through, as specified. And finally, I claim, in combination with the ribs having lateral slots, substantially as specified, the employment of card teeth interposed between the picker teeth, substantially as and for the purpose specified."

28. For an *Improvement in Valve Cocks;* John Griffiths, Philadelphia, Pa.

"The nature of my invention consists in making the valve with a cylindrical stem, passing through a hollow stem, which is attached rigidly to, or forms part of, the body of the cock, and is furnished outside with a screw, to which is fitted a nut, which carries a yoke, in which the valve stem is capable of turning freely, but not of moving longitudinally. By turning the nut the valve is raised and lowered from and to its seat, in a right line, the valve being always kept in such position that it will fall truly into its seat and close tightly."

Claim.—"What I claim is, the combination of the hollow fixed stem, the solid stem, and the yoked nut, substantially in the manner and for the purpose described."

29. For an *Improvement in Fire and Burglar Proof Safes;* F. C. Goffin, City of New York.

"The nature of my invention consists in filling the space between the two casings of a safe or vault door with glass or slag, when in a vitrified state, for the purpose of rendering the safe or door fire proof, and also proof against the efforts of burglars, glass being a poor conductor of heat, and so hard as to effectually prevent the operation of boring or drilling through the sides of the safe or door."

Claim.—"I do not claim forming safes or doors with double casing, for fire proof safes are at present constructed in that manner; but what I do claim is, the use of glass or slag in a vitrified state, for filling the space between the two casings of a safe or vault door, the glass or vitrified slag being poured molten into the space, or inserted in plates, which may be secured to the outer casing in any proper manner, and an air space left around the inner casing, as set forth."

30. For an *Improvement in Processes of Treating Vegetable Fibre;* Jonathan Knowles, Trenton, N. J.; patented in France April 4, 1853.

Claim.—"I am aware that Claussen has proposed to use, in his process, several of the salts I have mentioned, but in a different manner and with a different effect; but I make no claim to the use of any substance in any process such as he describes, nor in any other in which the bleaching and splitting of the fibre are effected separately. What I claim is, the method described of preparing vegetable fibre for picking, carding, spinning, and manufacturing into fabrics, by such machinery as is usually employed for performing the corresponding operations on ordinary cotton and wool, by first steeping or boiling it in a solution of alkali; second, washing it with water; third, steeping it in solution of chlorine bleaching compounds mixed with a solution of splitting salts, to bleach and split it simultaneously; and lastly, washing it with water and then drying it, as set forth, whereby the reduction of the fibre to its elementary filaments is expedited, and the expense thereof lessened by dispensing with much of the tedious manipulation and treatment heretofore practised, while, at the same time, the quality of the product is improved."

31. For *Improvements in Making Thick Paper;* Samuel G. Levis, Delaware Co., Pennsylvania.

"The nature of my improvement consists in an arrangement and combination of machinery for simultaneously forming two distinct fabrics of paper, and uniting them into one compound sheet by a continuous operation, and so that these component fabrics shall

be inseparably united; by this improvement, also, the thickness of the paper may be increased, and the strength and uniformity of the sheet of paper be preserved."

Claim.—"I do not desire to claim, generally, the employment of two forming cylinders, for the purpose of making paper of increased thickness, as cylinders have been thus used before; but what I claim is, the combination of the two forming cylinders, and the two endless felts, and the two squeeze rollers, arranged and operating in the manner and for the purpose substantially as described."

32. For an *Improvement in Fire Arms;* Thomas Cook, Assignor to Starkie Livesey, City of New York.

Claim.—"What I claim is, 1st, Cutting slots in the tubes of the magazine, and with each tube a spring connected with a ring moving on the outside, for feeding up the spring and maintaining the compressed position given at the time of charging the tubes with ammunition, as described, whereby I am enabled to force such charge into the conveyor, by power independent of gravity, and to pierce the hole communicating with the powder, in the manner described; and this I claim, whether the feed ring be combined with a screw exteriorly placed or within the interior of the cluster of tubes, or whether the same effect be produced by or in any manner analogous. 2d, Combining the tube magazine with the conveyor, in such manner that it will be revolved so as to bring each tube of the series successively opposite to the hole through which the charge is fed to the conveyor, whenever and so often as a charge has been transferred to the barrel, in the manner described. 3d, The follower in combination with the cavity of the conveyor, and the lever for ejecting the charge into the barrel, as described. 4th, The cam groove in combination with the finger levers, and the cap case, to regulate the feed, as described."

33. For an *Improvement in Machines for Pegging Boots and Shoes;* John Standish, Assignor to Jno. Standish and Horace A. Miller, Cuyahoga Falls, Ohio.

Claim.—"What I claim is, 1st, The vibrating guides in combination with the peg-feeding rack, awl, and driver, as described. 2d, The arrangement for feeding up the boot or shoe to be pegged; that is to say, the combination of the boot or shoe, held in a proper clamp, with the traversing frames, and with the irregularly curved rails or guides, as described. 3d, The method of regulating the feed by the rack, pawls, and weight, or spring, as described, the whole being constructed and operating substantially in the manner set forth."

34. For an *Improvement in Drying Cloth;* Robert Preston, North Pownal, Vt.

Claim.—"I claim the arrangement for bringing the bottom layer of the cloth within the drying chamber, to a suitable distance from the bottom of the chamber, so that it may be exposed to a proper and not too intense heat, consisting of the rollers, which are adjustable by racks and pinions or their mechanical equivalents, substantially as described."

35. For an *Improvement in Ships' Ventilators;* Warren Robinson, New Haven, Conn.

Claim.—"I am aware that a patent was issued to Enoch Hidden, New York, dated June 21, 1853, for side lights and ventilators for ships; I therefore do not claim any part, or process, or other matter claimed by said Hidden; but what I claim is, the combination of the movable part with the two inclined planes, when the whole is constructed, arranged, and combined, substantially as described."

36. For an *Improvement in Hanging the Fore Plate to Iron Rolling Machinery;* Jacob Reese, Sharon, Penna.

Claim.—"What I claim is, not the scouring of rolls, as described, nor yet the coupling of the upper roll when the rolls are to be scoured, and uncoupling it when they are in use; but what I do claim is, the hanging the fore plate of a rolling mill on centres placed either above or below the level of the rolls, by adding arms to the fore plate, working on a bar or pivots, for the purpose of removing the fore plate out of the way when the rolls are to be scoured without detaching it from the frame of the mill, substantially in the manner described."

37. For an *Improvement in Planting Hoes;* W. G. Sterling, Bridgeport, Conn.

Claim.—"I do not claim the blade with a tubular handle attached, neither do I claim the opening and closing an orifice for the discharge of the grain; but what I claim is, the cylinder in connexion with the tubular handle, and the lever, with the sliding plate attached, as described, or any other mode equivalent thereto."

38. For *Improvements in Apparatus for Controlling the Pressure of Steam;* Henry S. Williams, Malta, Ohio.

Claim.—"I do not claim admitting water from a steam pump or 'doctor,' for the purpose of controlling the pressure of steam in boilers, when said water is let on and shut off by the agency of a float; neither do I claim causing an alarm to be sounded when the supply ceases or when the pump is not running, through the agency of a float and steam cylinders combined; but what I do claim is, 1st, Opening the water cock of the steam boiler for the purpose of letting on water for reducing the temperature and pressure of the steam, and thereby preventing explosions, by means of a plunger and slotted arm, arranged and combined in the manner described, and operated, when the supply should be let on, by the pressure of the escape steam of the safety valve, and by means of a spring attached to the boiler and slotted arm, when the supply is being shut off, the whole being constructed and combined in the manner specified. 2d, I claim starting the steam pump or doctor running, in case it should not be in operation when the pressure of the steam in the boiler rises above the given point, by means of the escape steam from the safety valve, when admitted to the steam chest of the pump, through a branch pipe of that carrying the plunger, said branch pipe being provided with a valve, which prevents the steam from the doctor passing into the boiler when the pump is running, but allows of the steam being admitted to the steam chest when the pump is not running, substantially as set forth."

39. For an *Improvement in Drop Bridges;* Jacob D. Woodruff, Newark, and Joshua H. Butterworth, Dover, N. J.

Claim.—"What we claim is, the construction of a bridge or draw, which may be dropped below the surface of the water, so as to admit the passage of vessels over the same, substantially as described."

40. For an *Improvement in Machines for making Links of Jack Chains;* Arcalous Wyckoff, Wellsburgh, N. Y.

Claim.—"What I claim is, the fixed stud pin, and stud pin, placed at right angles to each other, in combination with the wiper and cutter, and cutter operated in the manner set forth, for the purpose of bending the two eyes of the link of the jack chains simultaneously."

41. For an *Improvement in Gas Burners;* John Webster and Orson Spencer, Assignors to John Webster, Cleveland, Ohio.

Claim.—"What we claim is, affixing or applying to a gas burner an oblong or elliptical shaped tube, so constructed and arranged as to deflect a portion of the gas escaping from the burner into the draft of air which passes up between the burner and the tube, so as to produce a more brilliant flame and more light from a given quantity of gas, substantially as described."

42. For an *Improvement in Saddle Trees;* George B. Ambler, Trumbull, Conn.

Claim.—"What I claim is, the combination of the crooper loop in one piece with the water hook, for the purpose of securing either in their respective positions, without the aid of screws or other appendages than those set forth, and to be used in the manner substantially as described."

43. For an *Improvement in Water Closets;* Frederick H. Bartholomew, City of New York.

Claim.—"I do not claim the use of the chamber when combined with the supply pipe or hydraulic main and the basin, by means of the common three-way plug turning cock, operated by the seat, as such combination has been before used in the water closet of Jordan; nor do I claim the puppet valve cock, with two valves and three ways, as new in itself; but, 1st, I claim a three-way cock with parts constructed and combined in the following manner, viz: having one principal chamber through which the water always passes, whether being received or discharged, two openings into which chamber being governed by two valves, operated by one stem, so that when one is opened the other is closed by the same action of the stem, the third way being without a valve, when these are combined with a second chamber for the accommodation of a short continuation of the valve stem through which the cock is operated, and one of the ways is placed between the principal chamber and the stem chamber, as described. 2d, Placing such a cock as described under the seat, or where it may be out of the way, and may be operated by a single rod, when said cock is connected by a tube with a chamber for the reception and

discharge of water under pressure. 3d, I claim, in combination with the double valve, an eduction way, employable for the double purpose of wasting out the water remaining in the pipes above the cock when not in actual use, and through means of which or whereby a communication is provided with chamber, for the purpose of keeping it charged with air, by means of valve or otherwise, at the same time that the said way is closed by valve against the escape of water from the chamber while the seat is depressed."

44. For an *Improvement in Horse Bells;* Jason Barton, Middle Haddam, Conn.

Claim.—"I do not claim the employment or use of two clappers or balls in each bell, for they have been previously used; but what I claim is, hanging or suspending the tongues within the bells, in the manner substantially as described, viz: having the tongues placed over curved holders, which are attached to the pad, said holders being within the bells, and so arranged that the tongue may be placed over them at different points, and thereby be suspended in the centres of the bells, irrespective of the positions which the pad and bells may have when attached to the body of the animal."

45. For an *Improvement in Machinery for Paging Blank Books;* J. L. Burdick, City of New York.

Claim.—"I do not claim the screw on the shaft for moving the cylinder laterally; but what I claim is, 1st, The type holders, substantially as set forth, in combination with the vertical type cylinder, for the purposes specified. 2d, The use of the vertical sliding rod or frame, having a rack attached thereto, in combination with the double-acting crank shaft and levers for operating the printing hammers, or substantially the same device, for the purposes set forth; and also the combination of the rack with the lever and rod, for drawing out the type holders, or their equivalent devices, substantially as set forth. 3d, The use of the vertical sliding rod or frame, having a rack attached thereto, for working the distributing inking rollers, in combination with the tape-holding lever, or their equivalent devices, substantially for the purposes set forth. 4th, The use of the vertical sliding rod or frame, having a rod attached thereto, in combination with the lever for operating the type-inking rollers, or their equivalent devices. 5th, The use of the vertical sliding rod or frame, having an arm attached to the cap piece of the frame, in combination with the sliding plate, and lever, and pawl, or their equivalent devices, for the purposes substantially as set forth. 6th, The use of the adjustable table and clamps, for holding the book while paging, in combination with the paging apparatus."

46. For an *Improvement in Machines for Stuffing Horse Collars;* John W. Howell, New Paris, Ohio.

Claim.—"What I claim is, the construction of the hopper, with an adjustable grate or crib bottom, in combination with the piston, funnel, clamps, and lever acting thereon, substantially in the manner set forth."

47. For an *Improvement in Fire Arms;* Horace Smith and Daniel B. Wesson, Norwich, Conn.

Claim.—"We do not claim the employment of a carrier or slide for transferring the cartridge from the magazine to the barrel, nor the employment, in combination therewith, of a piston or slide to force the cartridge out of the carrier and into the barrel; nor do we claim the employment of a piston slide as a breach to the barrel, nor the firing by 'concussion' instead of 'percussion;' nor do we claim the employment of making or applying the percussion hammer, so as to strike on the rear end of such piston, (instead of directly against the cartridge or its priming,) and so that the priming at the front end of the slide shall be exploded by concussion produced by the percussion or blow of the hammer on the other end of it, as specified. But we do claim the arrangement and application of the percussion hammer, with respect to the breech slide and the trigger guard lever, so that the hammer may be moved and set to full cock by the pressure or back action of the slide, induced by the action of the trigger guard lever, as specified. We also claim the improvement of making the front end of the piston slide with a dove-tailed recess, or its equivalent, for the purpose of enabling the slide to seize the metal of the cartridge, as explained, and so that the refuse metal or cartridge may be withdrawn from the barrel by the piston slide when next retracted, and discharged by the upward movement of the carrier, all substantially as specified."

48. For an *Improved Machine for Scraping and Toothing Veneer;* Allen Goodman and Lyman Wheeler, Dana, Mass.

Claim.—"What we claim is, a machine for scraping and toothing veneer, which has a

large feeding bed roll, around a portion of which the veneer is bent and held, and a revolving cylinder with scraping or toothing tools or knives inclined back from the axis of the said cylinder, so as to have a scraping instead of a cutting position, substantially as described."

49. For an *Improvement in Ball Valves for Pumps;* Joel R. Bassett, Assignor to Caleb H. Williams, Cincinnati, Ohio.

Claim.—"What I claim is, the method of aiding and ensuring the operation of the ball valve, by means of an intervening or dividing ridge placed between the openings, and forming part of the semi-annular chamber, as described, by which the valve is made to seek and occupy its appropriate seat when acted on by the discharge water in one or the other directions."

FEBRUARY 21.

50. For an *Improved Method of Operating Saws;* F. T. Andrews, Georgetown, D. C.

Claim—"What I claim is, the method described, of communicating the advance and receding motion to the saw, as and for the purposes set forth. Also, the combination and arrangement of the half beam lever and rocking link with the saw, when operated by a crank, or its equivalent, and pitman, connected at any point between the fulcrum of said lever and the saw."

51. For an *Improvement in the Mode of Attaching Horse Bells to Straps;* Jason Barton, Middle Haddam, Connecticut.

Claim.—"What I claim is, attaching spherical bells to straps by means of wires or rods, the bells being attached to the wires or rods, as described, and the wires or rods secured in any proper manner to the other side of the strap."

52. For an *Improvement in Window Cord Pulleys;* Jeremy W. Bliss, Hartford, Conn.

Claim.—"I do not claim, separately, of itself, making the box part of the shell and its face piece in halves, and fitting together by angular tags and recesses, as specified; but I do claim the shell and its face piece, in halves, fitting loosely together, as described, when combined with the wedge-formed seat and projecting tooth, constructed and arranged as specified, so that the pulley may be fitted together and in its place, with despatch, and be readily removed and taken apart for the convenience of cleaning, repair, or adjustment of the cord, without detaching the latter, and whereby the shell, with its pulley, when in their place, cannot be moved outwards without raising the sash and its weight; fastening screws are dispensed with, the chafing of the cord avoided, and the entry and removal of the pulley facilitated, as specified. I further claim the combination and arrangement of the back locking bolt with the wedge-formed seat and projecting tooth, as described."

53. For an *Improved Curved Sash Bolt;* E. G. Connelly, Indianapolis, Indiana.

Claim.—"What I claim is, the combination of the gravitating catch or bolt with the metallic case or box, giving said catch the form of an annular segment, or the segment of ninety degrees of a circle, combined with said metallic case of similar form, constructed and applied in such a manner that the expansion of the wood cannot retard or obstruct said catch or bolt as it inserts itself into the recesses or notches in the frame. I do not claim the recesses, or the material of the metallic case, or the catch; but the construction, formation, and application of said metallic case and catch, substantially in the manner and for the purpose described."

54. For an *Improvement in Stone Picking Machines;* John T. Foster, Jersey City, N. J.

"The nature of my improvement consists in combining three or more or less series of rows of teeth with a cylinder, secured on the axle of the cart, on rods running lengthways of the cylinder, in such a way as to fall back and be concealed in the cylinder as they come in contact with the discharging plate, so as to prevent any liability to locking the cylinder by stones wedging underneath them when falling into the discharging trough, as is sometimes the case in my original machine, and in their dropping out again as they get to the underside of the cylinder to pick up the stones again, and in which position they are held by spurs on the end of the rods, working or running over a cam attached to the cart frame for that purpose."

Claim.—"What I claim is, the use of a cylinder for picking stone or other articles, in combination with series of rows of drop teeth, and cam and spurs for operating the same,

substantially as set forth. I also claim the use of the solid discharging plate, and its combination with the drop teeth in a cylinder, and operated substantially as set forth, and the combination of the drop teeth with the adjustable rake."

55. For an *Improvement in Oar Locks;* Wm. Perry Glading, City of New York.

Claim.—"What I claim is, the application to oars of a cylinder, surrounded with a band and bolt, as described, for preventing the oar from wearing off against the row lock, and preventing the oar from slipping out of its place."

56. For an *Improvement in Derricks;* John B. Holmes, Boston, Massachusetts.

Claim.—" What I claim is, 1st, The combined arrangement of the collar upon the mast, the revolving platform supported upon it, and clamped below it, and the tension rods from said platform to the revolving mast head cap, in the manner and for the purposes described. 2d, Pivoting the heel of the derrick boom upon the revolving platform in the locality, substantially such as described; that is, upon that portion of the platform which is beyond the centre of the platform when measuring from the point of suspension of the weight."

57. For an *Improvement in Stretching and Drying Cloth;* D. and H. Stearns, Pittsfield, Massachusetts.

Claim.—" What we claim is, 1st, The means for stretching the cloth while wet, and carrying the same parallel while being dried, consisting of the endless belt of tenter hooks traveling in adjustable ways to accommodate different widths of cloth, which ways are parallel to each other, except at the ends, where they converge to allow the cloth to be hooked on, and stretch the same as it is moved forward, as specified; and, in combination with the above parts for stretching the cloth, we claim converging the ways at the delivery end to relieve the strain on the cloth, and allow the same to pass off the tenter hooks without tearing, as specified. 2d, We claim the heating cylinder and its adjustable roller, so arranged as to keep the cloth in contact with any desired portion of the cylinder, to heat and partially dry the cloth the amount required before it is stretched on the tenter hooks, as described."

58. For an *Improvement in Weaving Wire Screens;* Joseph M. Schuyler and William Zern, Assignors to Daniel L. Easterly, Pottsville, Pennsylvania.

Claim.—"What we claim is, causing the warp and weft wires to bend each other by means of clamps, levelers, or their mechanical equivalents, operating upon the warp wires each time the lay beats up the weft, for the purposes set forth. We also claim connecting the lay and clamp movements, so that the motion of the lay shall give motion to the clamps, substantially as set forth."

59. For an *Improvement in Contrivances for Protecting Passengers in Railroad Cars;* Samuel F. Holbrook, Boston, Massachusetts.

Claim.—"I do not claim to support the back rest by inflexible bars hinged to the floor, and made to turn so as to bring the back from over one side of the seat to over the other side of it, in order to enable a person to sit in one direction, or the opposite, as may be most convenient to him; nor do I claim the placing in the partition of a carriage, and opposite to, and about the height of the face of a passenger, a broad band of padding extended from one side of the carriage to the other, and to serve as a protection to the head of the passenger in case of accident; but I claim, as applied to a railway car or carriage, the above described improvement for supporting the back and head rests, or either, viz: by means of strong flexible bands, or their equivalents, extended from or near to the floor, to or near to the roof of the car, substantially as specified. And, in combination with the flexible bands, I claim the set of slide rails, or equivalents therefor, made to support the bands at one end of each, and to allow of their being moved from their angular inclination from one side of the vertical to a similar angular inclination on the opposite side thereof, in manner and for the purpose as stated."

60. For an *Improved Tool for Dove-Tailing;* Amos P. Hughes, Philadelphia, Penna.

Claim.—"I am aware that the several parts described are old, and I do not, therefore, claim them; but what I do claim is, the arrrangement and combination of the chuck, bit, saw, and plane iron, or their equivalents, substantially in the manner and for the purposes as specified."

61. For an *Improvement in Corrugating Metal Plates;* Richard Montgomery, City of New York.

"My improved method of operation consists in passing a plate a number of times through a pair of grooved rolls, and a stationary crimping die, by which the folds of the beam are gradually brought to the proper depth without endangering the rupture of the metal, which is unavoidable when the corrugation of folds of any considerable depth is effected by rollers alone."

Claim.—"What I claim is, the method described, of forming corrugated metal beams by passing a plate of metal of the proper size through a series of grooves between rolls, and through a series of crimping dies, substantially as set forth."

62. For an *Improvement in Whiffle-Tree Hooks;* Martin Newman, 2d, and N. C. Whitcomb, Lanesboro', Pennsylvania, and G. C. Cole, Hartford, Connecticut.

"The nature of my invention consists of a metal socket, either brass or iron, or other metallic substance, so constructed that it will make a safe, convenient, and durable fastening for whiffle-trees, cock-eyes, draw-irons on axles, hold-back irons on shafts, neck yoke fastener; also, to attach to the end of wagon tongues. The socket terminates with a hook or loop, and is provided with a spring bolt or latch, turning or swinging on a centre pin, and latching in a recess or notch, in such a manner that the traces or other parts will be in no danger of becoming unhooked."

Claim.—"What we claim is, the construction of a trace fastener on the ends of a whiffle-tree, consisting of a swing latch turning on a pin, detents and spring, in combination with a hook and catch, or detent thereon, operating in the manner and for the purpose of preventing the accidental displacement of the cock-eye on the end of the trace. We do not confine our claim to the use of the socket, in connexion with the spring latch arrangement, as the spring latch and hook may be used either on a socket, plate, or shank, as occasion may require, or in any other manner substantially as set forth."

63. For an *Improvement in Attaching Hubs to Axles;* Elnathan Sampson, Claremont, New Hampshire.

Claim.—"What I claim is, the united band and tube, secured to the inner end of the hub, combined with the tube and the axle by means of the single screw, in such a manner as to securely confine the hub to the axle, and also exclude the dust from, and retain the oil within the hub, substantially as set forth."

64. For an *Improved Machine for Slitting Clothes Pins;* John B. Smith, Sunapee, New Hampshire.

Claim.—"I claim the sliding saw frame or frames, operated on adjustable ways, in combination with the movable 'groove bed,' as described. I claim the grooved or fluted bed, whether said grooves are parallel with the shaft on which said bed is placed, or radiate from its centre. I claim the manner of setting off the 'groove bed,' by means of a ratchet, as shown, or its equivalent, a worm wheel operating on the nubs of the index; these nubs being the same in number as the grooves in the groove bed. I claim the lever paws, operated by springs, or their mechanical equivalents, pressure rolls to hold the pin while being slitted. I claim the application of the gauging spring for driving the approaching pin towards the end of the groove into which it has fallen. I claim the safety slide for the purpose of preventing the wrong passage of the saws; in short, I claim the construction of a self-acting machine for slitting clothes pins by means of one or more saws making one or more carths into the same or separate pins, at one advance of the saws, having the same appurtenances, and operated substantially in the manner set forth."

65. For an *Improvement in Seal Presses;* James Foster, Jr., Cincinnati, Ohio.

Claim.—"I do not claim substituting percussion force for pressure, in presses generally, nor even in seal presses; nor do I claim returning the piston or die of a press with a spring; but I do claim the combination of the following elements, or their equivalents, to wit: a frame work to sustain the boxes and guides for the piston, a spring piston bearing the die and surmounted by a knob, or suitable provision for receiving the blow of the hand, and guided by the groove and guide pieces, or their equivalents, substantially in the manner and for the purpose set forth."

66. For an *Improvement in Treating Hair for Weaving;* John Gledhill, City of N. Y.

"The nature of my invention consists in raising a bulb or knob on either side of the hair, by heat or chemical agency, for the purpose of preventing the hair slipping from the notched hook or other device by which it is wholly or partly drawn out from the bunch

and served to the loom, and insuring its being properly caught and held as long as is necessary."

Claim.—"What I claim is, preparing hair for being woven into cloth by raising a bulb or knob at either end, substantially as described, whether by the action of heat, or by any chemical agent, whereby the hair is made capable of being readily seized, and as readily relinquished, by a device which serves it to the operating parts of the loom."

67. For an *Improved Machine for Cutting Laths;* Chas. F. Packard, Greenwich, Conn.

Claim.—"I do not claim, separately, the knife working vertically, for that is well known; neither do I claim the toggle joint for working the cutters, for that is a well known device; but what I claim is, cutting laths from a log or block by means of the knife or cutter, having a vertical reciprocating motion, and the knives or cutters having a horizontal reciprocating motion, the cutters being arranged and operating substantially as described."

68. For an *Improvement in Spooling Yarn from the Cop;* Smith Thompson, Newburyport, Massachusetts.

Claim.—"I claim the regulator guide, as combined with the friction beam, and made to hang on the yarn, and be capable of being raised by it, substantially in manner and for the purpose as specified."

69. For an *Improvement in Threshers and Separators of Grain;* John Zink, Greensville, Virginia.

"The nature of my invention consists in the arrangement of the straw carrier and apron on the same shaking frame with the screen, so that the same motion which shakes out the grain from the straw, and carries the latter forward and out of the machine, shall also carry forward, on said apron, the grain to the screens and blast."

Claim.—"What I claim is, the arrangement of the straw carrier and apron on the same shaking frame with the screen, so that the same motion which shakes out the grain from the straw, and carries the latter forward and out of the machine, shall also carry forward on said apron the grain to the screens and blast, as described."

70. For an *Improvement in Machinery for Making Cordage;* Rufus Porter, Washington, D. C., Assignor to George Stephenson, Northfield, Indiana.

Claim.—"What I claim is, the arrangement, substantially as described, and the combination of the flyers, rollers, and drum, by which the longitudinal motions of the strands between the flyers and the laying point are equalized, the said rollers being made to rotate on their respective axles by the tension of the rope and strands."

71. For an *Improvement in Parti-Coloring Machines;* Solomon Smith, Assignor to himself and Wm. Schoaler, Acton, Massachusetts.

Claim.—"I claim dividing each of the horizontal layers or frames into two sections, and carrying the cloth from the lower to the upper sides of such sections between the contiguous inner ends of said sections. And, in combination with the said mode of using sections and carrying the cloth between them, I claim the improvement of making the end of one section lap by that of the other, so that the same contrivances used to compress the several frames together, or down upon one another, may also operate to compress the two sections together, and upon the cloth extending between them, as specified."

72. For an *Improvement in Applying Colors to Stone;* Hiram Tucker, Cambridgeport, Assignor to himself and Joseph Storey, Boston, Massachusetts; patented in England, September 24, 1852.

Claim.—"I do not claim the common process of applying water colors to paper by the use of a bath of size, and mixing such colors in water; nor do I claim the union of linseed oil and varnish made from kauri, in its use in connexion with a pigment, and in the common process of painting or spreading colors on a surface by means of a brush, my invention having special reference to the application of colors to a surface by means of a liquid or water bath; nor do I claim therein the use of either kauri, or oil alone; what I claim in the process of marbling, whereby an oil color, (or pigment mixed with a drying oil,) when applied to, or spread on the surface of a bath of water, or other suitable liquid, shall have imparted to it the property above mentioned; such improvement consisting in employing in such process the gum kauri, (or a like substance,) combined, as specified, with the drying oil, the same enabling a person, by means of a bath, to apply to a surface of stone, or other material, oil colors, so as to present the natural effects or appearance of any polished stone it may be desired to imitate."

FEBRUARY 28.

73. For an *Improvement in Scythe Fastenings;* S. B. Batchelor, Lowville, N. York.

Claim.—"What I claim is, the continuous rectangular slot or opening, in combination with the ring and screw, by which I am enabled to attach any common scythe to my snath, as herein set forth."

74. For an *Improved Machine for Splitting Hoops;* John W. Chittenden and Wm. C. Mead, Vevay, Indiana.

Claim.—"What we claim is, the feed rollers, the griping anvil, and bending rollers, or their equivalents, arranged and constructed substantially as described, in combination with a trip hammer, as described, for the purpose of racking or splitting apart timber for hoops."

75. For an *Improvement in Salt Kilns;* John P. Couger, Newark, New Jersey.

"The nature of my improvement consists in the construction of a kiln with small fires at each end, so as to apply the fire near to the boilers, having but a short arch over each fire, and conducting the flues immediately to the kettles."

Claim.—"I am aware that tubes have been used for the purpose of heating water for other purposes; therefore, I do not claim the invention of tubes; but the application of them to the making of salt, I believe, has never been made before; and by means of my new kiln I am able to make more in any given time, and with a vast deal less amount of fuel. What I claim is, the arrangement of a salt kiln having two small fires, with short arches over the grates at each end, and the flues thereof meeting in the middle of the kiln, and passing into tubes leading through the feed trough placed immediately above and along the kiln, in the manner and for the purposes set forth."

76. For an *Improvement in Seed Planters;* Lewis W. Colver, Louisville, Kentucky.

"The nature of my invention consists in so combining a pulverizer or cultivator with a seed planter, as that the soil shall be mellowed up, the furrow opened, the seed dropped therein and covered over, at one and the same operation."

Claim.—"What I claim is, the combination of the loosely hinged stocks with the teeth and shoes, and a seeding apparatus, substantially as described, and for the purpose of mellowing the soil, opening the furrows, dropping and covering the seed at one operation, as set forth."

77. For an *Improvement in Churns;* Robert W. Davis, Rodgersville, New York.

Claim.—"What I claim is, the manner described, of dividing the end pieces and hanging them eccentric to the axis of the dasher, in combination with the arrangement of the blades, so that the dasher may be adjusted by the resistance of the cream in revolving through it, so as to present six centripetal cutting or agitating blades to the cream; and then after the butter is produced, to be adjusted by reversing the motion of the dasher, and through the resistance of the butter, so as to present but two centrifugal gathering blades for gathering the butter, working it into rolls, and expelling the buttermilk therefrom, substantially as described."

78. For an *Improvement in Machines for Pulverizing Ores;* A. K. Eaton, City of N. Y.

Claim.—"What I claim is, a rotating dish or mortar, to hold the ore to be pulverized, and the water, mercury, or other liquids with which it may be advisable to mix the same, in combination with a vibrating rubber or pestle, which is made to traverse the bottom of the mortar, substantially as set forth."

79. For an *Improvement in Snow Ploughs for Railroads;* Abijah Hall and Sylvanus Sturtevant, South Paris, Maine.

Claim.—"What we claim is, so shaping, proportioning, and placing the notched shares of the snow ploughs that they will extend down within the inner sides of the rails, nearly to the cross-ties, without coming in contact with the chairs, for the purpose of removing snow and ice from the immediate vicinity of the inner sides of the rails, and, by means of their mould boards, discharging the same at a proper distance outside of the rails, substantially in the manner set forth."

80. For an *Improvement in Dies for Making Seamless Metal Tubes;* Timothy D. Jackson, City of New York.

Claim.—"What I claim is, a die for drawing seamless metal tubes, constructed with an eye, whose periphery is formed of a series of narrow friction rolls, which produce a

substantially equable extension of every part of the circumference of the tube being drawn, as set forth."

81. For an *Improvement in Quartz Crushers;* Smith W. Bullock, Assignor to Stillman, Allen & Co., City of New York.

Claim.—"I claim the application of gear wheels, solely for the purpose of causing the crushing wheels to turn on their axes faster (or make more revolutions) than they otherwise would in rolling around in the trough, the point of contact (or pitch line) of said gear wheels being on a line drawn from their common centre to a point upon the crushing wheels within its outer diameter, (or periphery,) thereby giving the periphery a slip or sliding motion upon the quartz."

82. For an *Improvement in Railroad Chair Machines;* Michael M. Gray, Phila. Pa.

"The nature of my invention consists in the manner of causing a series of punches, knives, and dies, and a former and its base, to operate upon a heated plate of malleable iron, so as to pierce, cut, and compress the same into the form of a railway chair in a better manner than before known."

Claim.—"What I claim is, operating the sliding former or mandrel upon the base or pedestal, to keep it firm and cool, and cutting, curling, and swedging the plates of metal to be formed into the chairs while in a stationary position, and at a proper heat, on the top of this sliding former, instantly, in the manner and by the means as described, to produce the chairs uniform in shape, and cheaply, of low priced or red short iron, without fracture."

83. For an *Improvement in Seed Planters;* Thomas D. Henson and George Rohr, Charlestown, Virginia.

Claim.—"What we claim is, the construction, use, and application of a revolving longitudinal shaft, having series of right and left, or double obliquely set beaters, and cleaning spikes, for the purpose as specified."

84. For an *Improvement in the Use of Fusible Disks in Steam Boilers;* Wm. Burnett and John Absterdam, Boston, Massachusetts.

"The nature of our invention consists in inserting in a steam boiler, at a point below the proper water line, and above all the heating surfaces, a pipe, which, at a suitable distance from said boiler, is stopped up by a plate of fusible metal, or other fusible compound, it being so arranged that by freely exposing said pipe to the atmosphere, the water contained therein shall have its temperature so far reduced by radiation as to preserve, in a solid state, a fusible metal that will be easily melted by the temperature of the steam in the boiler when the water level shall have fallen so low as to admit said steam into said pipe."

Claim.—"What we claim is, placing in a pipe which is connected with a steam boiler, a fusible plug or disk, said plug or disk being so far removed from said boiler, but so connected with the water therein, that when the water is sufficiently high, the plug or disk will be in contact, or so surrounded with water cooler than that in the boiler as to prevent it from being fused; but when the water in the boiler shall fall below a proper height, the steam will enter and come in contact with said plug, or so surround it as to cause it to melt, the same being for the purpose specified."

85. For an *Improvement in Zinc White Furnaces;* James Renton, Newark, N. J.

Claim.—"I do not claim to have invented any mode of treating the oxides, or other substances, after they are evaporated; but what I do claim is, 1st, The combination of any number of ore tubes, and tubes or spaces, placed side by side, and communicating with each other through openings in their sides, the ore tubes being exposed to a degree of heat sufficient to evaporate the oxides, or other substances contained therein, and make them pass through the openings into the tubes or spaces, the said tubes or spaces being protected from the heat by the ore tubes, and serving either to collect and condense the oxides, or other vapors, or to convey them to any other suitable receptacle, substantially as set forth. 2d, The hood or trunk, furnished with suitable openings for the admission of air, and placed over the air tubes, and tubes or spaces, for the purpose of receiving, leading off, and cooling, the oxides or other vapors escaping from the ores, substantially as described."

86. For a *Table to Hold Bank Notes when Cut;* Frank G. Johnson, Brooklyn, N. Y.

Claim.—"I do not claim the movable cutting board; neither do I claim the depressable

needle screws; but what I do claim is, the combination with a table of the movable cutting board, and the depressable needle screws, combined together, in the manner substantially as specified, for the purpose of cutting bank notes."

87. For *Improvements in Air Engines;* A. S. Lyman, City of New York.

Claim.—"What I claim is, 1st, The mode of preventing the waste of the compressed air, liquid carbonic acid, or other driving power, by interposing between it and the outer cylinder of the engine, a reservoir of water, or other suitable liquid, substantially in the manner described. 2d, The mode of applying the heat to the generating power through the agency of water, or other liquid, in the manner substantially as specified; thus avoiding the possibility of burning and scaling the metal, and also greatly increasing the extent of heating surface. 3d, The mode of preventing the loss of power otherwise caused by the expansion of the air, liquid carbonic acid, or other driving power, in passing through the repository and refrigerator, and being cooled and condensed before the working piston has completed its stroke, in the manner described; that is, by moving the generating plunger downwards as the working piston recedes from it, thus enlarging the heating chambers as fast as the air or other fluid expands. 4th, The combination of the generating cylinders with the opposite ends of the working cylinder direct, thus dispensing with contracted passages and pipes, causing the piston to move as rapidly as the working fluid moves. 5th, The construction of the heat repositories and restorers of small glass tubes, or glass rods, arranged substantially as described, for the purposes specified. 6th, The combination of the heater, the repository, and the cooler, substantially as described; the heater being above the repository, and the cooler below it, so that as the heat rises it does not tend to destroy the effect of the repository, but rather renders it more perfect. 7th. The partial isolation or separation of the upper part of the outer case containing the heating liquid, from the lower part containing the cooling liquid, by the introduction of bad conducting material between them. 8th, The combination of the external heater with the internal heater, and the combination of the external refrigerator with the internal refrigerator, substantially as specified, for the purposes set forth."

88. For an *Improvement in Machines for Making Bed Pins;* William McBride, Bristolville, Ohio.

Claim.—"What I claim is, attaching to a common turning lathe, a sliding cutter stock, and providing such stock with two peculiarly shaped cutters, one stationary and the other movable, the stationary cutter being of such shape that it forms a tapering part of the pin, while the movable cutter is of a proper shape and construction to form a round head on the pin, and simultaneous therewith, cut off the pin from the block, ready for being discharged, substantially as described. I also claim making all the pins of a set of a uniform length, by employing a spring plug or gauge, in the manner described, and by the same means effecting their discharge after being turned, headed, and cut off."

89. For an *Improvement in Cotton Picker Cylinders;* James Pitts, Lancaster, Mass.

Claim.—"What I claim is, the constructing the screen so that the periphery of the metal intervening between any two immediately adjacent orifices shall be of a length equal to, or greater than, that of the staple of cotton, or other fibrous material to be picked, in order that the fibre shall not lap around the said periphery, and become connected, attached, or tied by its ends, as stated. I also claim constructing the cylinder screen of a hollow perforated metal cylinder, without arms or ribs, and with open hollow cylindric journals at its two ends, as stated, in order that the cotton may be drawn out of one journal by the suction draft, and any obstruction removed by a person's hand and arm introduced through the other journal, as specified."

90. For an *Improved Socket for Bench Hooks;* Joseph Sawyer, South Royalston, Mass.

Claim.—"What I claim is, the described improvement in the socket of bench hooks, the hook being secured to the socket by the same screw and nut which fasten the whole to the bench."

91. For an *Improvement in Organs;* William Sumner, Worcester, Massachusetts.

Claim.—"What I claim is, the employment of a wind chest having a main passage for the wind and branches leading therefrom, and governed by valves, substantially as specified, and connected and combined with the keys substantially as and for the purpose specified. I also claim, in combination with a wind chest operating on the plan substantially as described, the employment of auxiliary bellows, connected and combined with the main bellows and pedals."

92. For an *Improvement in Harvesters;* Solyman Bell, Marseilles, Illinois.

Claim.—"What I claim are, the pins in the sickle, or their equivalents, in combination with the scores in the guards, or their equivalents, so constructed and operated as to remove the leaves and stalks, and prevent the guards from becoming clogged, so as to obstruct the motion of the sickle."

93. For an *Improved Tool Rest for Turning Lathes;* George A. Rollins, Nashua, N. H.

Claim.—"I am aware that the tool post of a lathe has been fixed on a plate or platform that could be inclined by means of a screw; therefore I do not claim such, but I claim the improvement of combining with the tool post and tool holder, a separate rest block, in combination with making the said rest block and the post, respectively, with a convex and concave vertical bearing surfaces, the tool holder with a head or dovetail, and the tool post with a curved trapezoidal or dovetail groove, as specified, whereby the cutting tool may not only be set to any angle of inclination, but the said tool and rest, simultaneously confined in position by the downward action of the screw of the tool holder against the tool, as described."

94. For an *Improvement in Seed Planters;* John G. Snyder and Joseph Yoring, Wheatfield Township, Pennsylvania.

Claim.—"What we claim is, the sliding section in the bottom plate, in combination with the tubes and revolving perforated plate, for rendering the machine capable of hill or drill planting, at pleasure, and ensuring a regularity of deposit, as set forth. Also, the aperture in the frame, in combination with the inclined form of the plate for carrying off the surplus grains, and collecting them in the bucket, substantially as specified."

95. For an *Improvement in Bank Locks;* Linus Yale, Newport, New York.

Claim.—"I do not claim the pins, or the sliding shaft, or the covering the key chamber with the broad head; but I do claim them as arranged in connexion with the cog, which prevents their being adjusted and turned by a burglar without the proper key."

96. For an *Improved Carrier for Lathes;* Jacob Zook, Harrisburgh, Pennsylvania.

Claim.—"What I claim is, the combination of the projections on the carrier plate with the vibratory arms and eccentrics, (attached to the same pivots,) or their equivalents, situated and adjustable in and combined with the auxiliary disk and bar, arranged and operating substantially in the manner and for the purpose set forth. I also claim giving a limited elastic play, longitudinally, to the bar in the disk, by means of the slots and springs, or their equivalents, substantially as described, in order that the pressure of the eccentrics, against the article to be turned, may be equalized, in case their bearing points should, by the irregularity or eccentricity of the article, be at unequal distances from the centre of revolution, which is determined and fixed by the conical point of the driving shaft."

97. For an *Improvement in Vulcanizing India Rubber and other Gums;* L. O. P. Meyer, Newton, Connecticut.

Claim.—"What I claim is, the heating or curing of the material commonly known as the hard compound of vulcanized caoutchouc, or other vulcanizable gums, by means of the immersion of the material in or under water, or other suitable liquid, during the process of heating or curing, substantially as described."

98. For an *Improvement in Forceps Saw Sets;* James F. Brodhead, Rondout, Assignor to Thomas Ritch, Napanock, New York.

Claim.—"What I claim is, the movable bed or anvil, operating conjointly with the levers, enabling the operator to set the tooth of the saw from its point, instead of from its base, as is usual in other forceps sets, as set forth."

99. For an *Improvement in Printing Presses;* Stephen P. Ruggles, Boston, Mass.

Claim.—"What I claim is, 1st, In combination with the curved arm for carrying the inking rollers to and from the form, the spring plates with the guides at each end of the rollers, for causing said rollers to pass over the form in a plane parallel to the form, their general motion being in the arc of a circle, substantially as described. I also claim hanging the platen and the intermediate ink roller to the same rock shaft by their respective arms, so that the vibration of the platen shall throw the intermediate roller first to the grooved ink roller, and then to the ink bearer, for the purpose of receiving and distributing the ink from the ink trough at every vibration of the platen, substantially as described."

ADDITIONAL IMPROVEMENTS.

1. For an *Improvement in Smut Machines;* Jacob Benner, Liberty, Penna.; dated Feb. 14, 1854; original patent dated Sept. 11, 1847.

Claim.—"What I claim is, making the slotted openings in the concave horizontal instead of vertical, as they are in the original patent, in the manner substantially as described. And secondly, the arrangement and combination of my machine in a close cover, together with the spouts or tubes, in the manner and for the purposes set forth."

2. For an *Improvement in Ploughs;* David Swartz, Tom's Brook, Va.; dated Feb. 28, 1854; original patent dated 22d June, 1852.

Claim.—"What I claim and desire to have added to my letters patent, of June 22d, 1852, is, attaching the comb or rake to the rear end of the mould board, by a crooked cam lever or bar and swivel, in combination with the hand lever, whereby it can be conveniently raised and lowered by rotating it upon its axis of connexion, substantially as in the manner and for the purpose set forth."

RE-ISSUES FOR FEBRUARY, 1854.

1. For an *Improvement in Carding, by which Variegated Slivers are produced;* Jonas Holmes and Ephraim French, Lee, Mass.; dated February 28, 1854; original patent dated May 18, 1852.

Claim.—"What we claim is, our mode of manufacturing the variegated roving or that composed of separate masses of fibrous material of different colors, laid together as described. Our said mode being a combination of processes, which consists in feeding or disposing the fibrous material upon the main card cylinder, in strands, bands, layers, or masses of different colors, and so that they shall be disposed side by side of each other, and around such cylinder, essentially as specified, and removing such fibrous material from the said main cylinder by a doffer or doffers, when constructed and made to operate therewith, substantially as specified."

2. For *Improvements in Grass and Grain Cutting Machines;* William F. Ketchum, Buffalo, New York; dated February 28, 1854; original patent dated Feb. 10, 1852.

Claim.—"What I claim is, 1st, Sustaining the outer end of the rack piece, in the manner set forth. 2d, The shield plate in combination with the shoe and cutter bar, for the purposes aforesaid."

DESIGNS FOR FEBRUARY, 1854.

1. For a *Cooking Stove;* Samuel D. Vose, Albany, New York; dated February 14th, 1854; ante-dated December 30th, 1853.
2. For a *Cooking Stove;* Samuel D. Vose, Albany, New York; dated February 14th, 1854; ante-dated December 30th, 1853.
3. For a *Cooking Stove;* Samuel D. Vose, Albany, New York; dated February 14th, 1854; ante-dated December 30th, 1853.
4. For a *Parlor Stove;* Samuel D. Vose, Albany, New York; dated February 14th, 1854; ante-dated December 30th, 1853.

Claim to each of the above, is the combination of the several ornaments and mouldings, as arranged together.

5. For *Parlor Stove Plates;* N. S. Vedder, Assignor to A. T. Dunham & Co., Troy, New York; dated Feb. 14th, 1854.

Claim.—"What I claim is, the ornamental design and configuration."

6. For *Coal Heating Stoves;* Conrad Harris and Paul W. Zoiner, Cincinnati, Ohio; dated February 21st, 1854.

Claim.—"What we claim is, the combination and arrangement of the ornamental figures, forms, and foliage, making an ornamental design."

7. For *Guitars;* Wm. B. Tilton, New York City; dated February 21st, 1854.

Claim.—"What I claim is, the plate placed within the rosette or opening in the sound board, and slightly below the interior surface of said board, said plate hiding the interior of the instrument from view, and adding to the ornamental appearance of the guitar."

8. For *Cast Iron Legs for Piano Fortes;* Frederick Starr, Rochester, New York; dated February 28th, 1854.

Claim.—"What I claim is, the ornamental design."

9. For *Cast Iron Pedal Lyre for Piano Fortes;* Frederick Starr, Rochester, New York; dated February 28th, 1854.

Claim.—"What I claim is, the ornamental design."

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

An Account of some Experiments on a Mixture of Saturated and Surcharged Steam, (Wethered's patent,) *made under the direction of* E. K. Collins, Esq. By B. F. Isherwood, Esq., Chief Eng., U. S. N.

(*With a Plate.*)

For some months past, by the public spirit and liberality of Mr. E. K. Collins, of the Collins line of Steamships, a very extensive and thorough course of experiments has been in progress, with what is known as Wethered's patent, having for their object such a treatment of steam as to greatly increase its power without any increased expenditure of fuel. The claim made in this patent by the patentees, Charles E., John, and Sam. Wethered, of Baltimore, Maryland, dated May 25, 1853, is as follows, viz:

"*What we claim as new is, the combining steam and superheated or surcharged steam, for actuating engines, when generated, the elasticity increased, and operated as set forth.*"

From this claim it will be seen that the patent does not intend the use of steam simply surcharged with heat; that is to say, having a higher temperature than is normal to the same pressure of saturated or ordinary steam; but it intends the use of *a mixture of saturated and surcharged steam.* I prefer these terms of saturated and surcharged steam to those of hydrous or anhydrous steam, or to those of steam and stame, because they are proper, and their meaning already understood; ordinary steam being saturated with water, or of maximum density for the pressure; and surcharged steam being ordinary steam surcharged with heat, having less than the maximum density for the pressure, and therefore not being saturated with water.

The idea of the patentee is, that if a certain quantity of saturated steam be withdrawn from the boiler, and heated (out of contact with water) to a high abnormal temperature, then *mixed* with a certain quantity of saturated steam, and this *mixture* used to actuate the engine, a greater power can be derived from it with a given weight of fuel than could be derived from the use of saturated steam alone, generated by the same weight of fuel.

The mode of obtaining the "mixture" for practical use is very simple, and as follows, viz: from the steam chimney or drum of the boiler, an usual steam pipe, furnished with the necessary stop valves, conveys externally to the boiler, the saturated steam to the valve chest; another similar pipe, with stop valves, &c., from the same steam chimney or drum, but starting within the smoke chimney, conveys saturated steam down the smoke chimney, through the flues and through the furnaces, passing immediately over the incandescent fuel, and then having become highly surcharged in its passage, it is led out of the front of the boiler to the same valve chest, where it is mixed with the saturated steam. From the valve chest the "mixture" passes to the cylinder of the engine, and actuates the piston in the usual manner.

In all the comparative experiments that have been made, the same engine and boiler was experimented with in both cases, being preserved in the same condition, and the results noted from the same instrument; every precaution was taken to ensure accurate *comparative* results; the same fuel was used, and the same persons employed. The experiments were open to all, and were conducted and visited by experienced engineers, wholly uninterested, pecuniarily, in the result; among the number was Mr. Daniel B. Martin, Engineer in Chief, U. S. Navy, who superintended several of the experiments in person, and by whose advice they were principally conducted. I am indebted to him for the detailed results below given.

The engine used was a common non-condensing one, the property of Mr. Collins, and kept by that public-spirited gentleman for making steam experiments. The diameter of the cylinder was $12\frac{1}{2}$ inches, the stroke of piston 12 inches, and it was worked without expansion; the cylinder was a double one, or surrounded with a steam jacket; the steam pipes were $2\frac{3}{8}$ inches inside diameter, and 8 feet long, being as direct as possible from the boiler to the cylinder. They were first covered with felt and woolen carpeting to 8 inches diameter, but the felt burning from the high temperature, it was removed, and a coating composed of a mixture of lamp black and clay, covered with felt and carpeting, was substituted. The boiler had vertical tubes, and was a working model of the boilers in the Collins line of steamships.

The work performed by the engine consisted in pumping up water into a tank, where it was kept at a constant level. Fitted to this tank was a very large air chamber containing compressed air, and the water was delivered from the pumps against the pressure of this air. The pumps were two in number, single acting, with 8 inches diameter, and 10 inches stroke of pistons; they had been made originally for air pumps to Mailfort's submarine apparatus, and they were worked from the shaft by means of eccentrics. The pump valves were of metal, with openings nearly as large as the pump barrel, and they were fitted up with the greatest accuracy. The pumps were set in the tanks with the water so disposed around and above them as to produce a head or pressure of $2\frac{1}{4}$ pounds per square inch, to overcome the friction and weight of the valves, the *vena-contracta*, &c., and to prevent there being below the pistons a less than atmospheric pressure. The air pressure in the chamber, against which the pumps delivered their water, was taken by three of Lowe's patent pressure gauges, carefully tested.

The temperatures were taken by accurate thermometers at three places; 1st, In the wrought iron steam pipe near the boiler, for the temperature of the steam; 2d, In the wrought iron pipe that carried the surcharged steam from the boiler to the valve chest; 3d, In the cast iron valve chest of the cylinder. In order to obtain these temperatures, three small cups containing mercury, and cast from the same pattern, just large enough to hold conveniently, the bulbs of the thermometers, without overflowing the mercury bath, were screwed in. The cups were about $\frac{1}{2}$-inch deep, and of course projected farther in the pipes than in the valve chest, where the metal was thicker.

With the apparatus just described, three distinct sets of experiments

were made; 1st, With saturated, or ordinary steam alone; 2d, With surcharged steam alone; 3d, With the 'mixture' of saturated and surcharged steam, in which the proportions of saturated and surcharged were about as 25 to 75.

The number of double strokes of engines' pistons made, was taken by a counter. The coal was accurately weighed, and the amount given is *inclusive* of what was required to raise steam; the coal was completely burned out, and the engine operated as long as it would work. The units of work done is obtained by multiplying the number of double strokes made by the pistons, by the pressure in the air chamber against which the pumps delivered their water.

Experiments made with Saturated Steam alone.

DATE. 1853.	Temperatures in degrees F. In steam pipe near boiler.	Temperatures in degrees F. In valve chest of cylinder.	Total number of double strokes of piston made during the experiment.	Pressure in air chamber (against which the pumps delivered their water) in lbs. pr sq. in. above atmo.	Pounds of anthracite coal consumed during the experiment.	Duration of the experiment in hours and minutes.	Total number of units of work done.	Units of work done with one pound of coal.	REMARKS.
Jun 11,	230°	217°	11143	25·25	336	6 21	281360·7	837·4	Wd westerly, weather clear.
" 24,	230	—	9732	30·46	347	6 00	296436·7	854·3	
July 6,	227	220	11940	22·25	343	6 00	265665·0	774·5	
" 7,	227	219	11620	23·75	334	6 00	275975·0	826·3	
" 29,	229	224	8682	26·50	301	6 00	230073·0	764·3	
Aug. 4,	231	226	10250	26·56	336	6 00	272240·0	810·2	Using salt water.
" 29,	228	229	5828	22·80	224	3 30	132878·4	593·2	
Totals,			69195		2221	39 51	1754628·8		
Means,	229°	222½°		25·36				790·0	

Experiments made with Surcharged Steam alone.

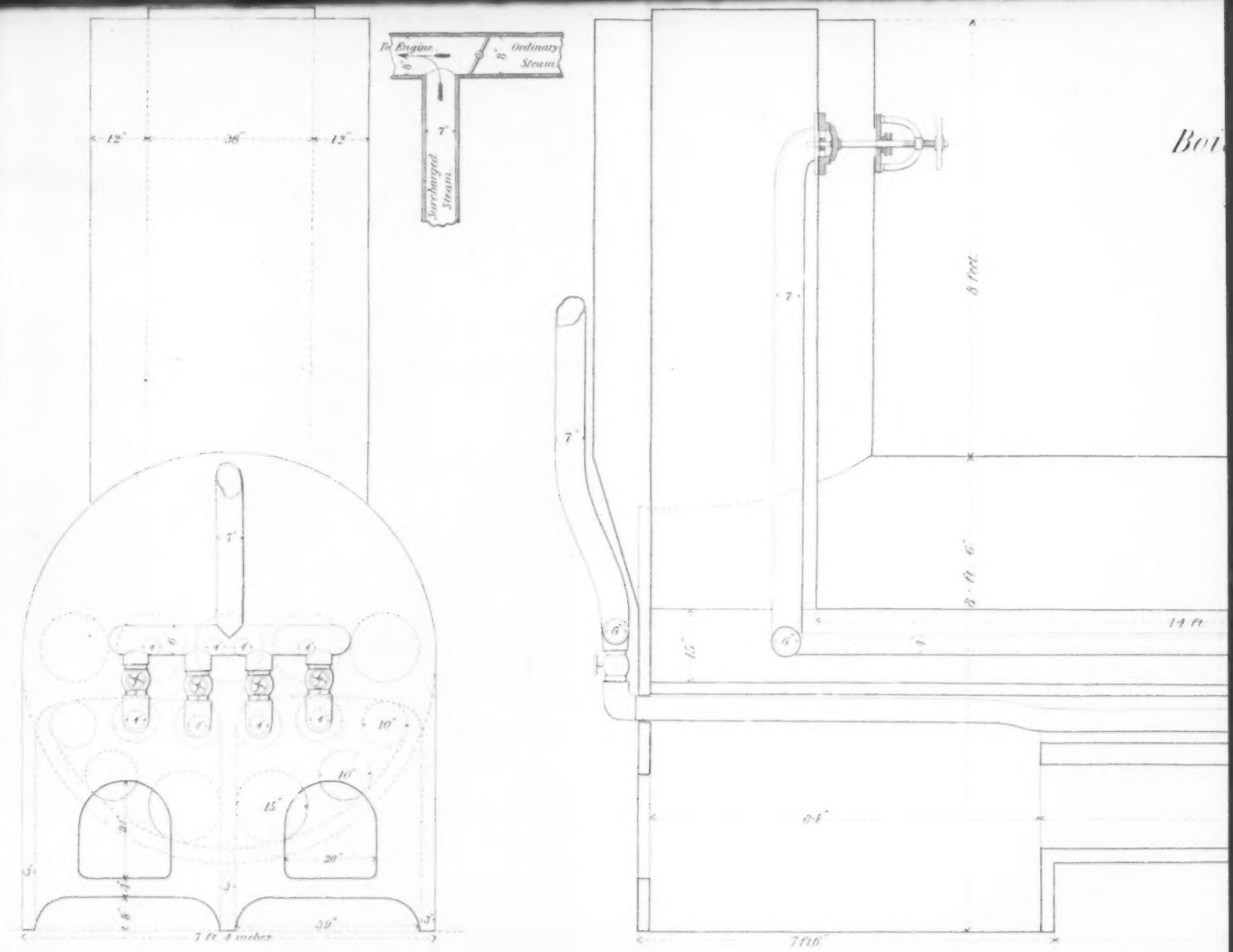
DATE. 1853.	Temperature of the surcharged steam in the pipe leading it from the boiler to the valve chest, in degrees Fahr.	Total number of double strokes of pistons made during the experiments.	Pressure in air chamber (against which the pumps delivered their water) in lbs. per sq. in. above atmos.	Pounds of anthracite coal consumed during the experim't.	Duration of the experiment in hours and minutes.	Total number of units of work done.	Units of work done with one pound of coal.	REMARKS.
Jun 25,	352°	11514	38·50	328	6 00	443289·0	1351·5	Wind westerly and weather clear.
July 2,	357	15220	28·33	348	6 00	431182·6	1239·0	
" 5,	348	14875	27·83	313	6 00	413971·2	1322·6	
Totals,		41609		989	18 00	1288442·8		
Means,	352½		30·97				1302·8	

Experiments with the Mixture of Saturated and Surcharged Steams.

DATE. 1853.	Temperatures in degrees Fah. In steam pipe near the boiler.	Surch'd steam in pipe leading from boiler to valve chest.	Mixture in the valve chest of cylinder.	Total number of double strokes of piston made during the experiment.	Pressure in air chamber (against which the pumps delivered their water) in lbs. per sq. in. above atmos.	Pounds of anthracite coal consumed during the experim't.	Duration of the experiment in hours and minutes.	Total number of units of work done.	Units of work done with one pound of coal.	REMARKS.
J'ne 13	233°	373°	—	15499	34·70	336	6 48	537815·3	1600·6	
" 30	237	379	304°	14630	31·20	272	6 00	456456·0	1678·2	
July 1	244	380	288	14736	28·40	256	6 00	418502·4	1634·8	
" 8	233	—	289	14810	32·60	288	6 00	482806·0	1676·4	W'd easterly & weather clear.
" 9	234	—	312	14676	28·20	289	6 00	413863·2	1432·1	
" 26	241	398	300	13310	41·10	280	6 00	547041·0	1953·7	Using salt water.
" 27	—	341	311	11772	38·10	299	6 00	448513·0	1500·0	" "
" 28	238	388	290	12671	38·14	268	6 00	483271·9	1803·2	" "
" 30	242	418	294	13520	30·21	248	6 00	408439·2	1646·9	" "
Aug 30	242	414	303	7171	40·00	210	2 20	286840·0	1365·9	Br'ke pump lever
" 31	238	394	303	8213	43·70	227	3 19	358908·1	1581·1	" "
Sep. 12	240	328	303	19855	38·20	467	10 00	758461·0	1624·1	
" 13	236	360	281	21214	34·70	459	10 00	736125·8	1603·8	
Totals.				182077		3899	80 27	6337042·9		
Means,	238⅛	379½	298⅛		34·84				1625·3	

Summary of the Experiments with the Pumps.

	With saturated steam alone.	With surcharged steam alone.	With the mixture of saturated and surcharged steams.
Duration of the experiments, in hours and minutes.	39 51	18 00	80 27
Temp. in deg. F. Saturated steam in the steam pipe near the boiler,	229°	—	238⅛°
Temp. in deg. F. Surcharged steam in the pipe leading from boiler to valve chest,	—	352½°	379½°
Temp. in deg. F. Mixture in the valve chest of the cylinder,	—	—	298⅛°
Total number of double strokes of pistons made during the experiments,	69195	41609	182077
Number of double strokes of pistons made per minute,	29·84	38·53	37·72
Pressure in air chamber (against which the pumps delivered their water) in pounds per square inch above atmosphere,	25·36	30·97	34·84
Total amount in pounds of anthracite coal consumed during the experiments,	2221	989	3899
Amount of anthracite, in pounds, consumed per hour,	55·7	55·0	48·5
Total number of units of work done,	1754628·8	1288442·8	6337042·9
Units of work done with one pound of coal,	790·0	1302·8	1625·3
Units of work done with one pound of coal reduced to proportionals,	1·0000	1·6491	2·0573


To Engine
Ordinary Steam
Superheated Steam
7'
12"
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7'
7'
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14 ft
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3"
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7 ft 4 inches
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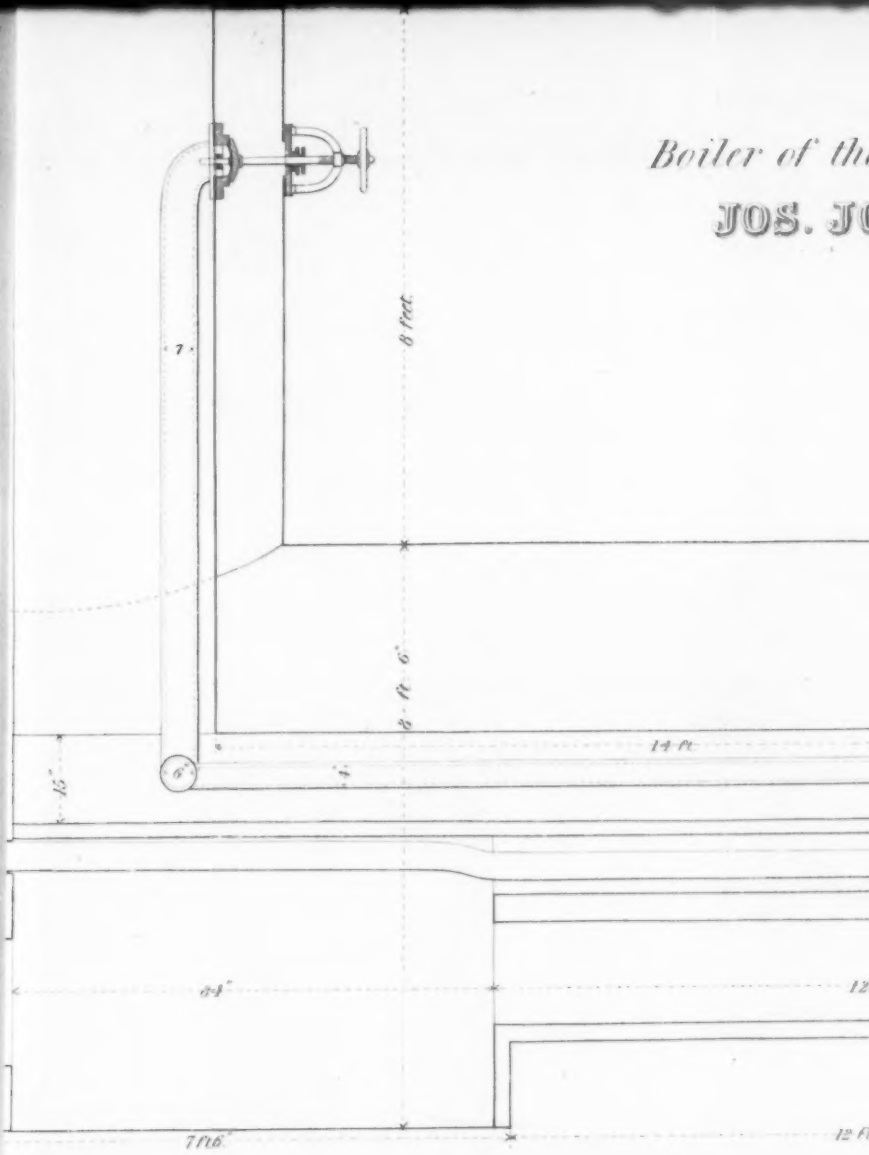
7 ft 6"


Boiler of th
JOS. J
7
8 feet
8 ft. 6"
14 ft.
15"
6"
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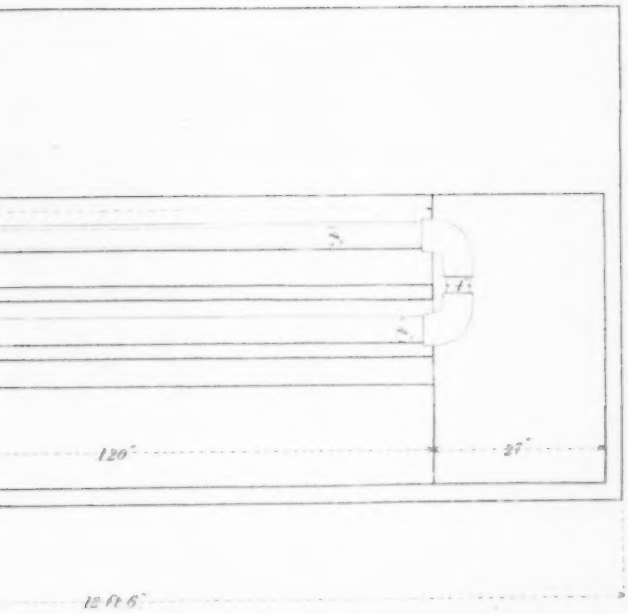
84"
12
7ft 6"
12 ft

of the Steamboat

OS. JOHNSON.



Total number of units of work done, . .	1754628·8	1288442·8	6337042·9
Units of work done with one pound of coal, .	790·0	1302·8	1625·3
Units of work done with one pound of coal reduced to proportionals, ...	1·0000	1·6491	2·0573

From this summary, it will be seen that, using the steam simply surcharged, produced, with the same fuel, an increased effect of 65 per centum over what was obtained with the saturated or ordinary steam alone; while an increased effect of 106 per centum was produced by the use of the "mixture." Also, the increased effect of the "mixture" was 25 per centum over what was obtained from the surcharged steam alone.

Experiments with Saturated Steam alone, and with a Mixture of Saturated and Surcharged Steam, on board the Steamboat Joseph Johnson.—After the experiments just described, made with the small stationary engine and pumps, it was considered still necessary to verify their results by operating with a steamboat under the ordinary condition of practice. For this purpose the *Joseph Johnson*, a tug steamboat, was obtained, and the experiments hereafter detailed were made with her on the Hudson River, at New York. These experiments were strictly comparative—the same instruments in the same positions—the same fuel, persons, &c., being employed, and every precaution was taken to secure accuracy. The weather, tide, &c., was also selected as nearly alike as possible.

The *Joseph Johnson* had one engine, with the cylinder 31½ inches diameter and 6¾ feet stroke of piston. The steam was cut off in the supply pipe by a fly-valve and cam-board at ⅝ths the stroke of piston from the commencement. (Plate VII.)

There was one iron boiler, with the furnace and direct flues below and single return ascending flues above. A steam chimney surrounded the smoke chimney, and the average temperature of the latter was 600° Fah.

The steam for the "mixture" was surcharged by taking it from the steam chimney inside the smoke chimney, leading it down the latter, then through the upper flues, then returning through the lower direct flues, and through the furnace over the incandescent fuel to the front of the boiler, whence it was led to the supply pipe, and there mixed with saturated steam, brought by a pipe externally to the boiler from the same steam chimney.

The following tables, furnished by Mr. Martin, who witnessed the experiments, contain, in detail, all the observed facts:—

Experiment with Saturated Steam alone, Jan. 9th, 1854. Air calm. Water smooth.

TIME. HR.	MIN.	Steam pressure in boiler in lbs. per sq. in. above atmosphere.	Vacuum in condenser per gauge in inches of mercury.	Mean temperature of the metal of the cylinder in degrees Fahr.	Temperature of the exhaust steam in degrees Fahrenheit.	Number of double strokes of piston made.	Number of double strokes of engine piston made per min.
A.	M.						
9	35	20	(Started engine, having used 1200 lbs. of coal in raising steam.)				
9	45	19	26½	223°	133°	Not noted.	
10	00	21	27¾	222	121	278	18·53
10	15	22½	"	222	121	294	19·60
10	30	22	"	218	120	296	19·73
10	45	22	"	220	122	298	19·86
11	00	21½	"	218	125	304	20·26
11	15	18½	27½	216	125	289	19·26
11	30	16	"	212	125	282	18·80
11	45	18	"	215	127	295	19·66
12	00	20	"	220	125	308	20·53
12	15	18½	"	214	119	293	19·53
12	30	15½	"	208	119	267	17·80
12	45	18	"	214	125	Stop'd 8 mn.	Not noted.
1	00	18	"	218	129	291	19·40
1	15	19½	"	226	125	299	19·93
1	30	21½	"	228	125	288	19·20
1	45	22½	"	222	125	297	19·80
2	00	16	28	208	121	288	19·20
2	15	12	28	216	115	266	17·73
Stopped 39 minutes.							
3	00	19	28	240	160	111	18·50
3	15	18	27½	240	125	273	18·20
3	30	18	27	238	128	276	18·40
3	45	18½	27½	241	127	285	19·00
4	00	18½	27½	240	123	290	19·33
4	15	20	27	244	127	299	19·93
4	30	21	27½	246	128	296	19·73
4	45	21	"	244	127	299	19·93
5	00	20½	"	242	125	310	20·66
5	15	20	"	240	123	288	19·20
5	30	22	"	244	125	272	18·13
5	45	21½	"	241	125	284	19·00
6	00	20	"	242	125	300	20·00
6	15	21	"	242	125	303	20·20
6	30	20	27¾	240	125	292	19·46
6	45	20	27¾	244	125	290	19·33
7	00	20	28	244	125	299	19·93
7	15	20	27½	244	125	292	19·46
7	30	20	"	244	125	296	19·73
7	45	19	"	242	125	289	19·23
8	00	19	"	242	125	297	19·80
8	15	18	"	240	125	284	18·93
Totals, 9 53						11447	19·303
Means,		19·5	27·5	231·1	125		

Experiment with a Mixture of Saturated and Surcharged Steam, January 5th, 1854.
Air Calm. Water perfectly Smooth.

TIME. HS.	MIN.	Steam pressure in boiler in lbs. per sq. inch above atmosphere	Vacuum in condenser per gauge in inches of mercury.	Mean temperature of the metal of the cylinder in deg. Fahr.	Temperature of the surcharged steam before its mixture with sat'd steam, in deg. F.	Temperature of the mixture of saturated and surcharged steam in deg. Fahr.	Temperature of exhaust mixture in degrees Fahr.	Number of double strokes of engine piston made.	Number of double strokes of engine piston made per minute.
A.	M.								
7	40	16	(Started engine, having used 1200 lbs. of coal in raising steam.)						
8	00	22	27½	236°	435°	308°	137°		
8	15	21½	28	248	455	315	139	306	20·40
8	30	21½	28	246	468	320	137	296	19·73
8	45	21½	27½	256	475	324	139	317	21·13
9	00	21½	"	265	500	332	143	319	21·26
9	15	20	"	275	500	346	150	317	21·13
9	30	20	28	277	530	336	148	300	20·00
9	45	20½	28	283	515	334	143	318	21·20
10	00	21	27½	283	525	340	145	330	22·00
10	15	20	28	286	540	350	147	309	20·60
10	30	20	28	294	560	358	145	310	20·66
10	45	21	28	294	580	358	145	32[illegible]	21·53
11	00	21	28	299	600	364	149	318	21·20
11	15	16	28	Stopped 2 minutes.		Data not noted.		Not	
11	30	15	27¾	280	490	322	153	noted	—
11	45	15	27½	290	505	330	145	"	—
12	00	16	"	290	530	348	150	"	—
12	15	18	"	294	572	366	152	"	—
12	30	17	"	292	560	356	145	"	—
12	45	15	28	297	615	360	150	"	—
1	00	13	28	304	670	370	155	"	—
Stopped 45 minutes.									
2	00	12	28½	254	488	310	137	281	18·73
2	15	15	28¼	262	500	325	135	272	18·13
2	30	18	28	280	535	344	154	291	19·40
2	45	18½	27½	290	545	360	160	309	20·60
3	00	19	"	298	582	370	140	319	21·33
3	15	20	"	304	605	378	155	323	21·53
3	30	19½	"	308	615	378	155	310	20·66
3	45	20	"	314	685	382	155	314	20·93
4	00	19½	"	314	680	370	153	312	20·80
4	15	19	"	312	685	375	145	304	20·26
4	30	19	28	313	680	370	155	312	20·80
4	45	19	27¾	308	670	360	150	314	20·93
5	00	19	28	302	690	360	145	312	20·80
5	15	19	28	303	720	376	140	307	20·50
5	30	18½	28	308	720	356	155	307	20·50
5	45	18	28	310	720	360	155	320	21·33
6	00	17	28¼	300	550	350	150	310	20·66
6	17	13	28½	294	550	340	145	Not noted.	
Totals, 9 50								11904	
Means,		18·5	27·8	289·2	577·1	350·7	147·6		20·176

Summary of the Results obtained from the Experiments made Jan. 5th and 9th, 1854.

	Saturated steam alone.	Mixture of saturated and surcharged steam.
Duration of the experiment in hours and minutes, . .	9 53	9 50
Steam pressure in boiler in lbs. per sq. in. above atmosphere,	19·5	18·5
Vacuum in condenser per gauge, in inches of mercury, .	27·5	27·8
Mean temperature of the metal of the cylinder, in degrees F.,	231·1	289·2
Temperature of the exhaust, in degrees Fahrenheit, .	125·0	147·6
Temperature of the surcharged steam before its mixture with the saturated steam, in degrees Fahrenheit, .	—	577·1
Temperature of the mixture of surcharged and saturated steams, in degrees Fahrenheit, ...	—	350·7
Total number of double strokes of piston made during the experiments, ...	11447	11904
Number of double strokes of piston made per minute, .	19·303	20·176
Pounds of anthracite coal consumed per hour, . .	666·664	440·824

Relative Economical Efficiency of the two modes of using Steam, as applied to the Steamboat Joseph Johnson, January 5th and 9th, 1854.—As the conditions under which the two experiments were made were sensibly the same, the cubes of the number of double strokes of engine piston, made per minute, will be taken for the expression of the useful effect obtained, and the consumption of coal per hour will be taken for the expression of the cost. Hence we have the following, viz:—

Double strokes of engine piston per minute.	Useful effect.	Lbs. of coal consumed per hour.	Cost.	Relative economical efficiency.

Saturated Steam alone.

$19{\cdot}303 = 1{\cdot}00000$ and $1{\cdot}00000^3 = 1{\cdot}00000$. $666{\cdot}664$ or $1{\cdot}00000$ and $\frac{1{\cdot}00000}{1{\cdot}00000} = 1{\cdot}00000$

Mixture of Saturated and Surcharged Steam.

$20{\cdot}176 = 1{\cdot}04523$ and $1{\cdot}04523^3 = 1{\cdot}14192$. $440{\cdot}824$ or $0{\cdot}66124$ and $\frac{1{\cdot}14192}{0{\cdot}66124} = 1{\cdot}72694$

Whence appears that the economical efficiency of the "mixture" is 72·694 per centum greater than that of the saturated steam alone.

The piston pressure in the two cases will be in the ratio of the squares of the number of double strokes of piston made per minute, or as 1·0000 to 1·0925; and the powers exerted by the engine will compare as the product of the piston pressures multiplied by the number of double strokes of piston made per minute, or as 1·00000 to 1·14192, or as the cubes of the number of double strokes of piston made per minute.

Experiment with Saturated Steam alone, Nov. 22, 1853. *Air Calm. Water Smooth.*

TIME. HS.	MIN.	Steam pressure in boiler in pounds per square inch above atmosphere.	Temperature in the steam pipe near the boiler, in degrees Fahrenheit.	Temperature of the steam in the valve chest of the cylinder, in degrees Fahrenheit.	Temperature of the exhaust steam, in degrees Fahr.	Number of double strokes of piston made by counter.	Number of double strokes of engine piston made per minute.	Total pounds of anthracite coal consumed.	Pounds of anthracite burned per hour.
10	21	24	240°	178°	130°				
10	51	23½	248	180	139	590	19·67		
11	21	25½	254	185	139	635	21·17		
11	51	18	240	174	130	578	19·27		
12	21	24	249	195	135	620	20·67		
12	53	21	250	209	135	589	18·41		
1	23	27	257	210	134	618	20·60		
1	53	24	252	210	132	688	22·93		
2	23	18	245	200	128	605	20·17		
2	53	20	245	205	130	613	20·43	2055	453·3
Totals, 4	32					5536		2055	
Means,		22·55	249·7°	195°	133·6°		20·352		453·3

Experiment with a Mixture of Saturated and Surcharged Steam, November 23, 1853. *Air Calm. Water Smooth.*

TIME. HS.	MIN.	Steam pressure in boiler in pounds per square inch above atmosphere.	Temp. of surcharged steam in pipe conducting it from boiler to valve chest, (before mixing,) in degrees Fahrenheit.	Temperature of the mixture in the cylinder valve chest, in degrees Fahrenheit.	Temperature of the exhaust of the mixture in degrees Fahrenheit.	Number of double strokes of engine piston made by counter.	Number of double strokes of engine piston made per minute.	Total pounds of anthracite coal consumed.	Pounds of anthracite burned per hour.
12	08	21							
12	38	23½	484°	342°		596	19·87		
1	08	20	552	348		625	20·83		
1	38	18	566	342		611	20·37		
2	08	18	600	330		592	19·73		
2	38	16	564	326		590	19·67		
3	08	18	600	326		616	20·53		
3	38	18	592	322		617	20·57		
4	08	20	600	331	From 130° to 140°.	590	19·67		
4	38	17	620	342		618	20·60	1300	288·9
Totals, 4	30					5455		1300	
Means,		18·94	578·3°	333·4°	135°		20·204		288·9

Summary of the Results obtained from the Experiments made Nov. 22 and 23, 1853.

	Saturated steam alone.	Mixture of saturated and surcharged steam.
Duration of the experiment in hours and minutes, . .	4 32	4 30
Steam pressure in the boiler in pounds per square inch above atmosphere, ...	22·55	18·94
Temperature of steam in the steam pipe near boilers, in degrees Fahrenheit, ...	247·7°	—
Temperature of steam in valve chest of the cylinder, in degrees Fahrenheit, ...	195°	—
Temperature of surcharged steam in the pipe conducting it from the boiler to the valve chest, (before mixing,) in degrees Fahrenheit, ...	—	578·3°
Temperature of the mixture in the cylinder valve chest, in degrees Fahrenheit, ...	—	333·4°
Temperature of the exhaust, ...	133·6°	135°
Number of double strokes of engine piston, made by counter,	5536	5455
Number of double strokes of engine piston, made per minute,	20·352	20·204
Total pounds of anthracite coal consumed, . .	2055	1300
Pounds of coal consumed per hour, . . .	453·3	288·9

Relative Economical Efficiency of the two modes of using Steam, as applied to the Steamboat Joseph Johnson, November 22d and 23d, 1853.—As the conditions under which the two experiments were made were sensibly the same, the cubes of the number of double strokes of engine piston, made per minute, will be taken for the expression of the useful effect obtained, and the consumption of the coal per hour will be taken for the expression of the cost. Hence we have the following, viz:—

Double strokes of engine piston per minute.	Useful effects.	Lbs. of coal consumed per hour.	Cost.	Relative economical efficiency.
Saturated Steam alone.				
20·352	or 1·00732 and $1{\cdot}00732^3$	$= 1{\cdot}02212$.	453·3 or 1·56916 and	$\frac{1{\cdot}02212}{1{\cdot}56906} = 0{\cdot}65142$.
Mixture of Saturated and Surcharged Steam.				
20·204	or 1·00000 and $1{\cdot}00000^3$	$= 1{\cdot}00000$.	288·9 or 1·00000 and	$\frac{1{\cdot}00000}{1{\cdot}00000} = 1{\cdot}00000$.

Whence appears that the economical efficiency of the "mixture" is $\left(\frac{1{\cdot}00000}{0{\cdot}65142} - 1.=\right)$ 53·51 per centum greater than that of the saturated steam alone.

The object in the above trial was to make the same number of revolutions of the wheels in equal times, so as to give the boat the same speed. The same distance was run (from Canal street wharf, New York, City, to Cold Spring, 56 miles,) with the "mixture" and with the steam

alone; and to keep the speed about the same, the time was noted at corresponding points along the river, so that the difference should tell in the fuel only. But with the "mixture," in order to keep the pressure sufficiently down, to obtain the same speed as with the steam alone, it was necessary to carry the fires ruinously low, so that at times portions of the grate bars would be entirely bare. It is to this fact that the lower result, comparatively, obtained from the "mixture" in the above trial is to be attributed.

From the experiments thus far made, no difficulty has been experienced from the burning out of the pipes conveying the surcharged steam. The data as given may be relied on as truthful, and the reader can account for the results in any way he chooses—of the practical facts there exists no doubt. I have given all the experiments that have been furnished me, and they include, I believe, all, or about all, that have been made.

For the Journal of the Franklin Institute.

Note on Dr. Wetherill's Remarks upon a Process for Organic Analysis.

By J. H. Alexander and Campbell Morfit.

All contributions which tend to make us acquainted with the resources of science or to extend its domain, are ever welcome; but all personal questions of individual laudation or criticism, unless connected with some point of scientific ethics, are generally unhappy, and always unimportant to the public.

If we understand Dr. Wetherill's remarks rightly, they are intended for the establishment of two points relating to the apparatus which we had occasion to describe in the February Number of the Journal, viz: 1st, That said apparatus is not new; 2d, That it is not an improvement, as we had supposed.

The first point is without interest to us, inasmuch as we have not raised it. Habitually careful of the possible rights of others as of our own, we forebore to claim an invention or to allege novelty. In our view, any process is to be appreciated in proportion to its convenience and utility. The fact of its not having been thought of or practised before, is of value solely to the individual concerned; and to him, in proportion to his aspirations after cotemporary celebrity or posthumous historical eminence. The last motives could not, at least they certainly did not, operate with us in devising or giving account of the process in question.

And the second point raised is nearly as indifferent to us as the former; since, after all the interesting references furnished by Dr. Wetherill, which show that the divers foreign processes and our own are not the same, the solution of the question of improvement must necessarily remain for some time a matter of mere opinion.

If any practical chemist is disposed to consider that the use of oxide of copper is always necessary, and that the cut-off at the reservoir instead of the combustion tube is the most convenient and fecund, and

that the elaborate and rather cumbrous fixtures for a gas furnace instead of the alcohol flame, are the most advantageous, and that the employment of a gauged reservoir tends to increase the doubts, we are quite content, with the most perfect respect, to leave such an one in quiet enjoyment of his ideas. We do not apprehend that they will be ultimately sustained by experience or entertained by the Profession.

Baltimore, 10th March, 1854.

For the Journal of the Franklin Institute.

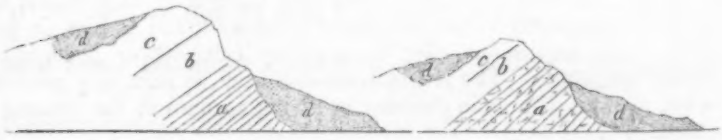
Magnetic-Iron Beds of the Penokie Range, on the South Shore of Lake Superior, in the State of Wisconsin. Condensed from Dr. Owen's Geological Survey of Wisconsin, &c. By Dr. L. TURNBULL.

(Continued from page 186.)

The most Easterly appearance of magnetic iron ore, which was observed by Colonel Whittlesey, was in fissile black slate, about four miles West of the Montreal Trail, in Section No. 4, W. The bed lies back of the trappose range, about sixteen miles from the Lake, in a protrusion of metamorphic slates. About four miles along the strike of the beds, South-west by West, the bed was seen by W. Randall, in 1848, in the Fourth Principal Meridian, in Township 44° North, eighteen miles from the lake. From thence he and his assistant traced it, at moderate intervals, along the uplift, to the West end of "Lac des Anglais," or about fifteen miles, to where the range terminates. Here the metamorphic slates are replaced by syenitic rocks.

There is a continuous bed of iron ore from the meridian westward to Lac des Anglais. Its thickness, richness, and value vary very much.

The geological relations of the iron-bearing strata are exhibited in the two following sections; the first taken near the trail that passes over the Pewabic Range, between the forks of the Tyler branch of Bad River; the second, South of Lac des Anglais.



d d, Drift.
c, Slaty Magnetic Iron, fifty feet.
b, Compact and Slaty Quartz.
a, Talcose Slate.

d d, Drift.
c, Iron bed, twenty-five to sixty feet.
b, Quartz, thirty feet.
a, Hornblende and Slaty Quartz.

On the Pewabic Range the strike of the beds is East by North; the dip North by West, 80° to 85. The beds of quartz are of great thickness—two hundred to two hundred and fifty feet. Near the junction of

the quartz and talcose slate the latter assumes the aspect of novaculite. The iron-bed is schistose in its structure, and is composed of magnetic oxide, sometimes alternating with beds of quartz.

The bed of magnetic iron ore, South of Lac des Anglais, is of extraordinary thickness—twenty-five to sixty feet. The proportion of iron and quartz is very variable, but the separation of them by mechanical means would, in general, not be difficult. The bands of ore vary from mere thin laminæ to a thickness of twelve and even eighteen inches, presenting, sometimes, a black surface, contrasting with the white and gray color of the quartz, and sometimes a bright metallic gray color.

There are many places in the mountain, West of Bad River, which present more than fifty feet of quartz and iron, in about equal proportions.

Where the West Branch of Tyler's Fork crosses this chain, W. Beesly found the Southerly face of the uplifts well charged with a rich, heavy ore, showing thirty-five and seventy feet, with iron predominating over quartz.

All the specimens were of the black magnetic oxide, without any of the red.

The productive yield of such an ore can only be determined by trial, in properly constructed furnaces; but, judging of the specimens by weight, they will afford fifty to sixty per cent. of metal. The following is an analysis of one specimen, by Dr. Owen, which yielded the following results:—

Analysis of Specimen No. 7, from the Slaty Beds of the Mountain South of Lac des Anglais.

Peroxide of Iron,	51·5	
Protoxide of Iron,	27·1	
Mixed Oxides of Iron,	78·6	=56·3=Iron.
Silica,	20·8	
Magnesia,	00·6	
Alkali,	00·2	
Fluoric Acid,	a trace.	
	100·2	

The excess arises from an absorption of oxygen by the protoxide. The analysis is subject to revision, if time permits, in this particular; but the result in pure iron cannot be materially changed. This specimen is apparently 10 or 20 per cent. below the richest pieces brought from the range, and is above some of the poorer slaty specimens.

For present use, a supply of ore may be obtained from the rubbish at the foot of the uplifts, in blocks and pieces already detached from the cliff and the accompanying quartz. Where it is not dislodged, it will be necessary to break the whole, and then assort it. There are cases where numerous particles of the oxide is disseminated through the quartz rock, above and below the regular beds. This might be separated by bruising and stamping—a process which the whole must undergo, in order to be profitably wrought in the forges.

There is no limestone yet known in the region to be used as a flux; but there is an abundance of timber and water-power.

There are certain proportions of iron and silex, and of silex and magnesia, that are easily fused. If the silex of this ore is not so excessive as to make it refractory, or if, in practice, that difficulty can be remedied by the use of magnesian slates, which are abundant, these mines may be wrought hereafter at a profit, and rival the works of Northern Europe.

The magnetic ores of the Northern part of the State of New York, that have produced iron famous for its strength, are also siliceous. The magnetic iron ore is freed of a portion of its silex, at little expense, after being bruised, by the application of magnets, acting on a large scale upon the magnetic particles. The part which enters chemically into the ore, forming a silicate, is not wholly cleared by working, but gives a very fine-grained metal that is peculiarly good for steel.

The famous Swedish iron is from beds of magnetic ore, embraced in hornblende rocks, doubtless metamorphic, and analogous to the Bad River rocks. The extensive mines or rather mountains of iron ore in Michigan, described by Houghton, Burt, Jackson, Foster, and Whitney, are also magnetic, and associated with metamorphic slates. These ores are, in some cases, more inclined to the peroxide than the Bad River beds; but specimens from the two regions are often so similar that no one would be able to separate them by the texture, color, or weight. The geological associations are precisely alike. In Michigan, as in Wisconsin, the mountains composed of tilted magnesian, hornblende, and siliceous slates, enclose beds of ore.

There, as here, on each side of the metamorphic range, are igneous rocks, of various ages and composition—quartzose, granetic, syenitic, and trappous. The ores of that region have attracted attention, and one establishment for making blooms direct from the ore has been in operation more than a year—(1852.) The iron is remarkable for its solidity and toughness, keeping its place better than Swedish, and no more brittle. It possesses the quality of being worked into fine cold-drawn wire, and has been sought after by an establishment for manufacturing wire in Massachusetts.

The blooms brought from Lake Superior to the Pittsburgh market are, however, represented as being inclined to "red short," that is, liable to crack under the roller or hammer, at about a red heat.

The position of the best exposures of ore which Colonel Whittlesey saw, was such as to require from eighteen to twenty-eight miles of transportation to reach the lake. The nearest natural harbor is in Chegwoi-egin Bay, about twenty-five miles from the central part of the Kenokie Range. At Montreal River, which is the nearest part of the coast, and from its mouth to the mouth of Bad River, there is no place where an artificial harbor can be made. At Bad River there will be a good harbor, when the sand-bar at the mouth is removed, and kept clear by the construction of piers.

(To be continued.)

Translated for the Journal of the Franklin Institute.

Specific and Latent Effects of Vapors. By MM. FAVRE and SILBERMANN. (*Ann. de Chem. et de Phys.*, April, 1853, p. 461.)

MM. Favre and Silbermann have, by means of their Mercurial Calorimeter, found the following values:—

Name of the Substance.	Specific Heat.	Latent Heat.
Bicarburet of Hydrogen, (from Amylic Alcohol. Boiling point, 200°–210° Cent.,)	0·489	59·91
Bicarburet of Hydrogen, (from Amylic Alcohol. Boiling point, 240°–260° Cent.,)	0·496	59·71
Wood Spirit,	0·671	263·86
Wine Alcohol,	0·644	208·92
Amylic Alcohol,	0·587	121·37
Sulphuric Ether,	0·503	91·11
Acetic Ether,	0·483	105·80
Essence of Turpentine,	0·467	68·73
Sulphurous Acid,		94·56

Archives des Sciences Phys. et Nat. vol. xxiii, p. 385.

Translated for the Journal of the Franklin Institute.

Condensation of the Gases by Porous Bodies. By MM. FAVRE and SILBERMANN. (*Ann. de Chem. et de Phys.*, April, 1853, p. 471.)

M. Mitscherlich sought to determine, by calculation, the state in which carbonic acid must exist in the pores of the charcoal, after the absorption of the gas; and he arrived at the conclusion, that at least one-third of the condensed carbonic acid must be in a liquid state on the surface of the cells, and that this liquid layer was not thicker than 54 thousandths of a millimetre, distributed over the whole absorbing surface. The layer would be thicker for other gases more easily absorbable and liquifiable.

It was interesting to know the heat disengaged by this condensation; we might hope to obtain some data or some suitable hints upon the numbers which express the latent heat of liquifaction of some gases which it would be difficult to determine directly.

MM. Favre and Silbermann have found that one gramme of gas, condensed by charcoal, disengages

Chlorhydric Acid, 232·5
Sulphurous Acid, 139·9 } Units of heat.
Carbonic Acid, 129·6

One gramme of Charcoal absorbs, of Chlorhydric Acid, 69·2 cubic centimetres.
" " Sulphurous Acid, 83·2 "
" " Carbonic Acid, 45·2 "

On comparing the heat disengaged by the condensation of sulphurous acid with its heat of vaporization, we find that the first surpasses the second by 45·34 units.

This difference is so great that it may include the latent heat of solidification of the sulphurous acid, so that it is not impossible that the gas may be fixed in the same state as the coloring matters or certain salts which carbon has the property of removing from water.

If we admit that the liquid sulphurous acid wets the pores of the

charcoal, the experiment leads us to allow a part of the heat disengaged as due to the affinity of the charcoal for the liquified product.

These experiments show no ratio between the power of condensation of charcoal and the solubility of the gases in water.—*Archives des Sciences Phys. et Nat.* vol. xxiii, p. 386.

For the Journal of the Franklin Institute.

Particulars of the Steamer Quaker City.

Philadelphia.—Hull built by Vaughan & Lynn. Machinery by Merrick & Sons. Owners, American Steamship Company. Intended service, Philadelphia and Charleston.

Hull.—		
Length for tonnage,		230 feet.
Length on deck,		240 " 3 inches.
" deep load water line,		225 " 4 "
Breadth of beam at midship section,		36 "
Depth of hold,		21 " 3 "
Length of engine space,		76 " 4 "
Shaft, forward of stern post, at deep load line,		91 "
Draft of water at deep load line,		12 "
Tonnage, custom house,	1421	
Area of immersed section at load draft,		390 sq. feet
Contents of bunkers in tons of coal,	180	
Masts and rig—Foretopsail schooner.		
Engine—One—Side lever.		
Diameter of cylinder,		85 inches.
Length of stroke,		8 feet.
Maximum pressure of steam in pounds,	28	
Cut off variable from $\frac{1}{4}$ to $\frac{3}{4}$ stroke.		
Maximum revolutions per minute,	20	
Boilers—Four, return tubular, 2 forward, 2 aft of engine.		
Length of boilers,		14 feet.
Breadth "		10 " 4 inches.
Height " exclusive of steam drum,		11 " 1 "
Number of furnaces in all boilers,	16	
Breadth of furnaces,		2 "
Length of grate bars,		7 " 3 "
Number of tubes in all boilers,	800	
Internal diameter of tubes,		3 "
Length of tubes,		9 "
Heating surface,		7820 sq. feet.
Diameter of smoke pipes (two),		5 feet 3 inches.
Height "		35 "
Description of coal,	Anthracite.	
Draft,	Natural.	
Consumption of coal per hour, (expected,) 3000 pounds.		
Paddle Wheels.—Ordinary radial.		
Diameter over blades,		30 feet 4 inches.
Length of blades,		10 "
Depth "		20 inches.
Dip of wheels at load line,		5 " 3 "
Average revols. per min., (expected) at above pressure, and draft of water,	17	

Remarks.—Braced with diagonal double laid iron straps, $4\frac{1}{2} \times \frac{5}{8}$. Floor filled in solid. Frames moulded 16 inches, sided 15. Apart 30 inches, increasing at ends to 31, 32, and 33 inches. Has Pirsson's surface condenser, with 2430 square feet of tube surface.

For the Journal of the Franklin Institute.

Results obtained from Testing the Strength of an Iron Girder, recently constructed at the Architectural Iron Works of J. A. GENDELL & Co., *Philadelphia.* By B. SEVERSON.

The girder, 34 feet 6½ inches long, 2½ feet deep at the middle of its length, and weighs 3450 pounds. It is designed for a floor girder for a store, where it may be required to bear a uniform load of 20 tons. It was placed on piers or bearings 33 feet apart, making a clear span of 33 feet. A platform of this length was then suspended under the girder, by means of nine suspenders passing over its upper chord or flanch, and placed about four feet apart. The platform was then uniformly loaded with pig iron, accurately weighed. This load was made 32 tons on the first day. The next day, during the forenoon, it was raised to 42 tons, and in the afternoon of this same day to 52 tons. At this stage of the trial one of the piers yielded sideways, causing the girder to twist so as to produce a lateral deflexion of about six inches, and must have broken had the load not come down on to some blocks placed on the ground in anticipation of such a result.

As this put a stop to further trial, the load was now removed, and to the utter astonishment of all, the girder resumed its original form, with the exception of a slight lateral bend, in consequence of the unnatural lateral strain produced by the yielding of the foundation. But in the vertical direction—the only way it could have been strained when properly fixed in a floor—it has quite come up to a straight line on its under side, just as it was originally formed; thus showing that the material has not been strained beyond its elastic limit, and therefore its strength is not impaired in this direction. If, then, as writers on the strength of iron state, the elastic limits are equal to only about one-third of its ultimate strength, this girder would, in a proper position, have borne over 150 tons. This may be too high a figure; still, from the data furnished, it is believed that it would bear from 90 to 100 tons. This opinion is not only based upon the above facts, but the general appearance of the effect of this load on the girder was closely observed, with a view to decide beforehand the limits of its strength, and also to decide at what point it would be most likely to fail. The opinion seemed to be general among those who witnessed the trial, that, under fair circumstances, it would bear a load of from 90 to 100 tons. The amount of deflexion, as well as its form, was also carefully noted for the same purpose; but this was so regular and uniform throughout, that no indication of anything but uniform strength could be gathered from this. Nor could any other clue be discovered from which even an opinion could be formed whether the girder was weakest at the middle, the ends, or at intermediate points.

Taking into consideration the weight, length, and depth of this girder, and the result of this test is believed to be superior in value to any other ever published. For the purpose of comparing results with others, I have selected one of the malleable tubular girders, and, I believe, one of the best of Fairbairn's experiments, made prior to the construction of the Britannia Bridge. The one I refer to was 31 feet 6 inches long,

clear span 30 feet, and weighed 44 cwt. and 3 qrs. Last observed deflexion, 3·03 inches, and breaking weight 57½ tons. The deflexion of mine, under a load of 51 tons, (last measurement,) was $1\frac{5}{16}$ inch, and, under a load of 57½ tons, it would not, at this rate, have exceeded 1½ inch, or about one-half the deflexion of the tubular girder under the same amount of load. And, notwithstanding mine is *longest by three feet*, and weighs about *one-third less* than the other, yet mine was not injured by the strain of a load of 52 tons, while the other broke down under a load of 57½ tons. Or, the tubular girder failed under about 25⅔ times its own weight, while mine, with the disadvantage of 3 feet greater length—(this is a disadvantage when compared in this way)—stood under 30⅔ times its own weight, without sustaining *any injury*. And, so far as the amount of deflexion indicates the measure of strain, it would seem that mine might stand under sixty times its own weight, or would bear over 100 tons. And, in order to determine fully as to all the merits, and strike the balance between the two girders, it becomes necessary to take into consideration the probable cost of labor and materials used in each. In mine is used one piece of cast iron, weighing 2820 pounds, and two malleable ties, weighing 630 pounds, in all=3450 pounds; while the tubular girder is presumed to have been made wholly of malleable iron, which is much more expensive than cast iron. Therefore, taking into consideration the difference between the first cost of 2820 pounds of cast iron in mine, and an equal amount of malleable iron in the other, (leaving the 630 pounds in my ties against an equal amount in the other,) and add the difference to the entire cost of the one-third greater weight of the tubular girder, together with the greater cost of labor in making the tube, and the difference will be one-third or one-half in favor of mine; and yet, as before shown, mine possesses nearly if not quite double the value of the other in strength.

I do not feel disposed to underrate the skill and scientific attainments of others, but the question of *girders* is an important one, and if I have succeeded in devising one of superior merit, its importance will be readily appreciated. If there are any errors in the form or construction of this girder, I wish them to be pointed out. It *can* be seen now, just as it came out of the trial. I wish some of the members of the Institute would come and make an examination.

Philadelphia, March 10, 1854.

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*On Soap as a Means of Art.** By Ferguson Branson, M.D., Sheffield.†

Several years ago I was endeavoring to find an easy substitute for wood engraving, or rather to find out a substance more readily cut than wood, and yet sufficiently firm to allow of a cast being taken from the surface when the design was finished, to be re-produced in type-metal

* Dr. Branson has also employed bees' wax, white wax, sealing wax, lacs, as well as other plastic bodies; and in some of these cases a heated steel knitting-needle, or point, was substituted for the ivory knitting-needle.—Ed.

† From the London Artizan, February, 1854.

or by the electrotype process. After trying various substances, I at last hit upon one which at first promised success, viz., the very common substance called soap, but I found that much more skill than I possessed was required to cut the fine lines for surface printing. A very little experience with the material convinced me that, though it might not supply the place of wood for surface printing, it contained within itself the capability of being extensively applied to various useful and artistic processes in a manner hitherto unknown. Die-sinking is a tedious process, and no method of die-sinking, that I am aware of, admits of freedom of handling. A drawing may be executed with a hard point on a smooth piece of soap almost as readily, as freely, and in as short a time as an ordinary drawing with a lead pencil. Every touch thus produced is clear, sharp, and well defined. When the drawing is finished, a cast may be taken from the surface in plaster, or, better still, by pressing the soap firmly into heated gutta percha. In gutta percha several impressions may be taken without injuring the soap, so as to admit of "proofs" being taken and corrections made—a very valuable and practical good quality in soap. It will even bear being pressed into melted sealing wax without injury. I have never tried a sulphur mould, but I imagine an impression from the soap could easily be taken by that method. The accompanying specimens will show, that from the gutta percha or plaster cast thus obtained, a cast in brass, with the impression either sunk or in relief, can at once be taken. If sunk, a die is obtained capable of embossing paper or leather; if in relief, an *artistic* drawing in metal. This suggests a valuable application. The manufacturer may thus employ the most skilful artist to make the drawing on the soap, and a fac-simile of the actual touches of the artist can be reproduced in metal, paper, leather, gutta percha, or any other material capable of receiving an impression. By this means even high art can be applied in various ways—not a translation of the artist's work by another hand, as in die-sinking, but the veritable production of the artist himself. One of the specimens sent is a copy of Sir E. Landseer's "Highland Piper," a rude one, I must confess, though its rudeness does not militate against the principle involved in its production. Suppose the drawing had been made by Sir E. Landseer himself, that accomplished artist's actual drawing might have been embossed on various materials in common use, and disseminated amongst thousands, thus familiarizing the eyes of the public with high art, and giving a value to the embossed transcript which no translation by the die-sinker, however skilful, could possibly give it. The raised gutta percha impression of this specimen is from the soap itself; the sunk impression is cast in gutta percha from gutta percha. The works in metal, during the 14th, 15th, and 16th centuries, owe their excellence, in a great degree, to the combination in the same individual of artist and artisan. The metal was finished by the artist himself, who left the stamp of his genius unmistakably upon it. By the plan just explained, something like a return to this combination might be effected, and the artist would, at least, have the satisfaction of finding his own work accurately rendered, and not enfeebled, in the translation; for the art of casting in metal has of late been so much improved, that little difference can be detected between the impression on the cast and

the mould which produced it. I wish to lay particular stress upon the fact that *drawing touches* can be thus rendered, and an effect *rapidly* produced, unattainable by modelling. The larger plaster casts were taken from drawings freely made—as the appearance of the touches will prove—in common brown soap. The finer kind of soap is, of course, better fitted for fine work; but should the process now described be adopted by the manufacturer—and I trust it may never become the subject of any patent—soap better suited to the purpose than any now made will doubtless be specially manufactured. In proof that fine lines can be drawn upon the soap as well as broad vigorous touches, I can state that one of Rembrandt's etchings has been copied on soap, the soap pressed into gutta percha, and an electrotype taken from the gutta percha cast, from which a print has been obtained, very little inferior in delicacy to the original etching. Doubtless, persons engaged in manufactures will see applications of the process which I have not contemplated, and I leave it to their ingenuity to discover them. I would particularly call the attention of ornamental leather and paper manufacturers, bookbinders, and, possibly, manufacturers of china, to the process; for it must be remembered that soap, when made, can be run into moulds of any form, so as to obtain curved as well as flat surfaces for the artist to draw upon. It has also occurred to me that it would prove a very ready and expeditious method of forming raised maps, pictures, and diagrams for the use of the blind. The manipulation is very simple. A lead pencil drawing, if required, can readily be transferred to the smoothed surface of the soap, by placing the face of the drawing on the soap and rubbing the back of the paper; every line of the drawing is then distinctly visible on the soap. The implements used are equally simple: all the specimens sent were drawn with ivory knitting-needles, and small ivory netting-meshes for scooping out larger and deeper touches. The only caution necessary is to avoid under-cutting. Having felt the greatest interest in the establishment of schools of design, so well calculated to re-connect fine art with manufactures, it will afford me sincere gratification if the simple process now pointed out—and I trust its simplicity will be no bar to its being carefully tested—shall be in the smallest degree instrumental in accomplishing the re-union.

Sheffield, December 31*st*, 1853.

P.S.—The date 1850 is on some of the illustrative specimens.—*Journal of the Society of Arts.*

Identity of Dynamic or Voltaic Electricity with Static or Frictional Electricity. By Professor FARADAY.*

The Friday evening meetings for the season commenced at the Royal Institution on Friday last, the opening lecture being delivered by Professor Faraday to a very crowded audience. The subject was the developement of electrical principles produced by the working of the electric telegraph. To illustrate the subject, there was an extensive apparatus of voltaic batteries, consisting of 450 pairs of plates, supplied by the Electric

*From the London Mechanics' Magazine, January 7.

Telegraph Company, and eight miles of wire, covered with gutta percha, four miles of which in coils were immersed in tubs of water, to show the effects of submersion on the conducting properties of the wire in submarine operations. The principal point which Professor Faraday was anxious to illustrate, was the confirmation which experiments on the large scale of the electric telegraph have afforded of *the identity of dynamic or voltaic electricity with static or frictional electricity.* In the first place, however, he exemplified the distinction between conductors and non-conductors, impressing strongly on the audience that no known substance is either a perfect conductor of electricity or a perfect non-conductor, the most perfect known insulator transmitting some portion of the electric fluid, whilst metals, the best conductors, offer considerable resistance to its transmission. Thus the copper wires of the submarine electric telegraph, though covered with a thickness of gutta percha double the diameter of the wire, permit an appreciable quantity of the electricity transmitted to escape through the water; but the insulation is, nevertheless, so good that the wire retains a charge for more than half an hour after connexion with the voltaic battery has been broken. Professor Faraday stated that he had witnessed this effect at the Gutta Percha Works, where one hundred miles of wire were immersed in the canal. After communication with a volatic battery of great intensity, the wire became charged with electricity, *in the same manner as a Leyden jar*, and he received a succession of forty small shocks from the wire, after it had been charged and the connexion with the battery broken. No such effect takes place when the coils of wire are suspended in the air, because in the latter case there is no external conducting substance. The storing-up of the electricity in the wire when immersed in water is exactly similar to the retention of electricity in a Leyden jar, and the phenomena exhibited correspond exactly with those of static electricity, proving in this manner, as had previously been proved by charging a Leyden jar with a volatic battery, that dynamic and static electricity are only different conditions of the same force; one being great in quantity, but of low intensity, whilst the latter is small in quantity, but of great intensity. Some interesting facts connected with the conduction of electricity have also been disclosed by the working of the submarine telegraph, which Professor Faraday said confirmed the opinion he had expressed twenty years ago, that the conducting power of bodies varies under different circumstances. In the original experiments by Professor Wheatstone, to ascertain the rapidity with which electricity is transmitted along copper wire, it was found that an electric spark passed through a space of 280,000 miles in a second. Subsequent experiments with telegraph wires have given different results, not arising from inaccuracy in the experiments, but from different conditions of the conducting wires. It has been determined that the velocity of transmission through iron wire is 16,000 miles a second, whilst it does not exceed 2700 miles in the same space of time in the telegraph wire between London and Brussels, a great portion of which is submerged in the German Ocean. The retardation of the force in its passage through insulated wire immersed in water is calculated to have an important practical bearing in effecting a telegraphic communication with America; for it was stated that, in a length of 2000

miles, three or more waves of electric force might be transmitting at the same time, and that if the current be reversed, a signal sent through the wire might be recalled before it arrived at America. Professor Faraday concluded by exhibiting a beautiful experiment illustrative of the identity of volatic and frictional electricity. The terminal wires of a powerful secondary-coil apparatus were placed seven inches apart within the receiver of an air pump, and when the receiver was exhausted, a stream of purple colored light passed between the wires, resembling, though more continuous and brilliant, the imitation of the aurora borealis produced when an electric spark is passed through an exhausted glass tube. The volatic power employed to produce this effect of static electricity was only three cells of a Grove's battery.

Researches on Evaporation. By Professor MARCET, of Geneva.*

The following experiments were instituted with the view of throwing some light on the tendency of certain circumstances to promote or diminish the evaporation of liquids. Water and alcohol were the liquids chiefly used. The results obtained by the author may be recapitulated as follows:—

1. The temperature of a liquid, allowed to evaporate freely in an open vessel, is always inferior to that of the surrounding atmosphere. The higher the temperature of the atmosphere, the greater is the difference between its temperature and that of the liquid exposed to evaporation. Between 40° and 50° Centigrade the difference was found to vary from 5° to 7°; between 20° and 25° it varied from $1\frac{1}{2}$° to $1\frac{1}{4}$°; at 12° it was 0·8° only, and between 3° and zero about 0·2°. The explanation of this result is obvious. The evaporation of a liquid diminishing with the external temperature, the cold, which is the consequence of this evaporation, must diminish in the same proportion; and if it were possible to prevent evaporation altogether, the author presumes that there would be no difference whatever between the temperature of a liquid and that of the surrounding medium.

2. The temperature of liquids, such as water and alcohol, as well as the rapidity with which they evaporate, varies, all other circumstances remaining the same, according to the nature of the vessel in which these liquids are contained. For instance, the temperature of the surrounding atmosphere being from 15° to 20°, water is, on the average, 0·3° warmer in an open metallic vessel than in a similar one of polished porcelain, and 0·2° warmer than in a similar one of glass. It is the same with alcohol. Again, both water and alcohol evaporate more rapidly from a porcelain vessel than from a metallic or glass vessel of precisely the same size. For example—three similar vessels, one of metal, the second of porcelain, and the third of glass, containing each 600 grains of water, having been exposed to evaporation during seven days, the temperature of the surrounding atmosphere varying from 20° to 25°, it was found, that at the end of that time, the porcelain vessel had lost 303 grains of its previous weight, the metallic one 277, and the glass vessel 275·5

* From the London Repertory of Patent Inventions, January, 1851.

grains only. The author enters into considerable detail as to the precautions he took to make sure that these differences could not be attributed to any difference in the radiating or conducting powers of the vessels employed.

The differences observed in the temperature of liquids, according to the nature of the vessels in which they are contained, depends, no doubt, on the property with which these vessels appear to be endowed, of accelerating or delaying evaporation. It is evident, that in each case the quantity of sensible heat subtracted from the liquid, or, in other words, the diminution of its temperature, must be in proportion to the quantity of vapor formed. For instance, the fact that water and alcohol are constantly colder in a porcelain vessel than in a similar vessel of metal or glass, is the natural result of the more rapid evaporation of these liquids from the former of these vessels than from the two latter. The reason why a porcelain vessel evaporates more freely than a metallic or glass one is far less evident. The author has proved, by placing a hermetically-closed bottle of porcelain, containing water, under the vacuum of the air pump, that it cannot be owing to any perviousness of the sides of the vessel, as he was at first inclined to suspect.

3. The influence of the mass or depth of a liquid was next examined. The author's experiments appear to lead to the curious fact, that the rapidity with which any given liquor evaporates depends not only on the extent of its surface, but also, within certain limits, on its depth. He found, for instance, that with two similar cylindrical porcelain vessels, containing, the first a layer of water of one-twelfth of an inch in depth, and the second a layer of half an inch, the evaporation from the latter exceeded that of the former in the proportion of nearly 4 to 3. A similar result was obtained with alcohol. If thin glass vessels were used, the same increase of depth accelerated the evaporation in the proportion of 6 to 5. As the author himself observes, this apparent influence of the depth of a liquid on its evaporation, may, very possibly, be merely owing to the greater facility with which the different layers are conveyed, one after the other, to the surface, when the liquid is of a certain depth than when it is quite shallow.

4. Water containing a solution of salt in about the same proportion of sea water, evaporates less rapidly, and, consequently, produces less cold than the same quantity of distilled water. The higher the temperature of the surrounding atmosphere, the greater the difference between the quantities of salt and fresh water evaporated in a given time, under similar circumstances.

5. A given quantity of water, mixed with certain pulverulent substances, such as a siliceous sand, for the particles of which it has but a slight adhesion, evaporates more rapidly than the same quantity of distilled water *alone*. The fact was ascertained in the following manner:—The author, having procured two small porcelain vessels, exactly of the same size, introduced into one of them 300 grains of distilled water, and into the other a small quantity of siliceous sand, over which 300 grains of water were poured, so as not only to saturate the sand, but also to leave a layer of water of about one-tenth of an inch in thickness over and above its surface. At the end of five days, it was observed that the

water standing alone had lost 184 grains of its previous weight, while the water mixed with the sand had lost no less than 196 grains. The average difference, resulting from a series of experiments, was $7\frac{1}{2}$ per cent. in favor of the more rapid evaporation of water mixed with sand compared with that of water standing alone. If the experiment be made with glass or metallic vessels, the difference is only about $4\frac{1}{2}$ per cent.

6. The last result which we shall mention, and which may be regarded as a direct consequence of the preceding one, is the following:—Water mixed with sand remains habitually at a slightly lower temperature than an equal surface of water standing alone. The difference varies to a certain extent, according to the nature of the vessels in which the experiment is performed, never, however, exceeding half a degree Centigrade. It is greater when the comparison is made between water and wet sand placed in two similar metallic vessels, than when they are placed in porcelain or glass vessels; in the latter case it seldom exceeds 0·1° to 0·2°.

The author concludes by remarking, that the foregoing result tends to confirm an opinion expressed some time since by Professor De la Rive, in a letter to M. Arago, published in the *Comptes Rendus de l'Académie des Sciences* for October, 1851. In this letter, M. De la Rive attributes the sudden appearance of vast glaciers in divers parts of Europe to a temporary refrigeration produced at the period of the elevation of the most recent European strata, by the evaporation of the water with which they were previously covered. If, as the author's experiments tend to show, evaporation takes place more rapidly from water mixed with sand, earth, or any similar substance than from a surface of clear water, it becomes natural to conclude, that the cold produced by evaporation from the recently-elevated and still humid strata, must have been greater than that resulting from the evaporation of the sea or freshwater lake which covered them previously to a great depth.—*Bibliothèque Universelle, April*, 1853.

Translated for the Journal of the Franklin Institute.

Cast Iron for Artificial Magnets.

M. Crahay found, several years ago, that cast iron may acquire, by tempering, a coercitive force sufficiently great to allow it to be strongly and permanently magnetized. The grey iron is the best for this purpose. The pot metal is too brittle, and the first quality of cast iron gives but moderate results.

The permanence of the magnetism depends on the temper. A bar tempered at a dull red heat, may be powerfully magnetized, but loses its force in twenty-four hours. If the tempering is done at a red heat, the bars not only will take a powerful magnetism, but keep it indefinitely. Experiment has shown, that the following is the best mode of tempering large bars. They are to be heated to redness in a wind furnace, then withdrawn, one by one, the two faces of the bar are sprinkled for three-fourths of their length with yellow prussiate of potassa, and immediately plunged into a great mass of cold water, stirring it about violently.

A little more thickness should be given to bars of cast iron than to steel.—*Proceedings of the Royal Academy of Belgium, 29th July*, 1853. *L'Institut, 9th November*, p. 379.

For the Journal of the Franklin Institute.

Particulars of Several Steamers, the Machinery of which are built by Messrs. Reaney, Neaffie & Co., of Philadelphia.

Steam tug for Wilmington, N. Carolina; hull built by Linn and Byerly, Philadelphia.

HULL.—

Length on deck,		94 feet.
Breadth of beam at midship section,		20
Depth of hold,		8 "
Length of engine space,		33 "

ENGINE.—One—Condensing, vertical direct acting.

Diameter of cylinder,		30 inches.
Length of stroke,		26 "
Maximum pressure of steam in pounds,	30	
Cut off at half stroke.		

BOILER.—One—Return flue.

Length of boilers,		20 feet.
Breadth "		7 " 6 inches.
Height " exclusive of steam drum,		8 "
Number of furnaces,	2	
Breadth of furnaces,		3 "
Length of grate bars,		5 " 3 "

PROPELLER.—

Diameter of screw,		7 feet 9 inches.
Length of screw,		5 " 3 "
Number of blades,	4	

—

Steam tug *Walpole;* hull built by Bideman and Watson, Philadelphia.

HULL.—

Length on deck,		94 feet.
Breadth of beam at midship section,		22 "
Depth of hold		8 "
Length of engine and boiler space,		36 "

ENGINE.—One—Condensing, vertical direct acting.

Diameter of cylinders,		32 inches.
Length of stroke,		30 "
Maximum pressure of steam in pounds,	30	
Cut off at half stroke.		

BOILER.—One—return flued.

Length of boilers,		21 feet.
Breadth "		8 " 3 inches.
Height " exclusive of steam drum,		8 " 6 "
Number of furnaces,	2	
Breadth "		3 " 6 "
Length of grate bars,		5 " 3 "
Heating surface,		980 square feet.

PROPELLER.—

Diameter of screw,		8 feet 6 inches.
Length "		5 " 9 "
Number of blades,	4	

Ferry boat for Camden and Absecom Railroad Company; hull built by T. Byerly, Philadelphia.

HULL.—

Length on deck,		100 feet.	
Breadth of beam at midship section,		22 "	
Depth of hold,		9 "	
Length of engine and boiler space,		33 "	

ENGINES.—One—Inclined, condensing.

Diameter of cylinders,			28 inches.
Length of stroke,		7 feet.	
Maximum pressure of steam in pounds,	25		
Cut off at half stroke.			

BOILER.—One—Flue and return tube.

Length of boiler,		20 feet.	
Breadth "		7 "	6 inches.
Height " exclusive of steam drum,		8 "	
Number of furnaces,	2		
Breadth "		3 "	
Length of grate bars,		5 "	6 "

PADDLE WHEELS.—

Diameter of water wheel,		17 feet.	
Length of boards		7 "	
Depth "			15 inches.
Number "	14		

—

Steamer *J. R. Hammitt*, for Laguyra and Porto Cabello Steamship Co.; hull built by J. R. Hammitt, Philadelphia.

HULL.—

Length on deck,		116 feet.	
Breadth of beam at midship section,		24 "	
Depth of hold,		9 "	
Length of engine space,		34 "	
Contents of bunkers in tons,	15		

ENGINE.—One—Vertical, condensing, geared 2 to 1.

Diameter of cylinder,			34 inches.
Length of stroke,			36 "
Maximum pressure of steam in pounds,	20		
Cut off at from commencement of stroke,			18 "
Average revolutions per minute, estimated,	26		

BOILER.—One—Flue and return flue.

Length of boiler,		20 feet.	
Breadth "		8 "	
Height " exclusive of steam drum,		8 "	3 inches.
Number of furnaces,	2		
Breadth "		3 "	
Length of grate bars,		5 "	6 "

PROPELLER.—

Diameter of screw,		7 "	6 "
Length of screw,		5 "	
Number of blades,	4		

Steamer for coasting, not named; hull built by T. Byerly, Philadelphia.

HULL.—

Length on deck,	140 feet.	
Breadth of beam at midship section,	24 "	6 inches.
Depth of hold,	8 "	
Length of engine space,	34 "	
Contents of bunkers in tons, 15		

ENGINE.—One—Vertical condensing, geared 2 to 1.

Diameter of cylinder,		34 inches.
Length of stroke,		36 "
Maximum pressure of steam in pounds, 20		
Cut off at from commencement of stroke,		18 inches.
Average revolutions per minute, estimated, 36		

BOILER.—One—Flue and return flue.

Length of boiler,	20 feet.	
Breadth "	8 "	
Height, " exclusive of steam drum,	8 "	3 inches.
Number of furnaces, 2		
Breadth of furnaces,	3 "	
Length of grate bars,	5 "	6 "

PROPELLER.—

Diameter of screw,	7 "	6 "
Length "	5 "	
Number of blades, 4		

—

Steam tug for Humboldt Bay and Pacific Coast; hull built by T. Byerly, Philadelphia.

HULL.—

Length on deck,	91 feet.	
Breadth of beam at midship section,	23 "	
Depth of hold,	10 "	
Length of engine space,	35 "	

ENGINES.—Two—Direct acting, condensing.

Diameter of cylinder,		24 inches.
Length of stroke,		24 "
Maximum pressure of steam in pounds, 30		
Cut off at from commencement of stroke,		12 inches.
Average revolutions per minute, estimated, 65		

BOILER.—One—Flue and return flue.

Length of boiler,	21 feet.	
Breadth "	9 "	
Height, " exclusive of steam drum,	10 "	
Number of furnaces, 2		
Breadth of furnaces,	3 feet	6 inches.
Length of grate bars, (to burn saw mill refuse,)	7 "	

PROPELLER.—

Diameter of screw,	7 feet	3 inches.
Length "	4 "	9 "
Number of blades, 4		

Remarks.—In addition to those particularized, there are in construction by the same Company, for boats varying from 50 to 85 feet in length, engines with cylinders ranging from 16×16, to 24×24, intended for towing on the Hudson, Delaware, and Mississippi rivers. Though small, these engines are enabled, from the pressure of steam employed, to develop considerable power; those of the average class frequently towing

three coal laden brigs and schooners, at the rate of three to four miles per hour in slack water; while their size makes them manageable with but few hands, thus making them economical.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, March 16, 1854.

John E. Addicks, Esq., President, P. T.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Donations to the Library were received from La Societie d'Encouragement pour l'Industrie Nationale, Paris; The Society of Arts; The Royal Astronomical Society and the Institute of Actuaries, London; The Mercantile Library Association, St. Louis, Missouri; The Young Men's Mercantile Library Association, Cincinnati, Ohio; The American Institute, City of New York; J. L. Losing, Boston, Mass.; The Allegheny Valley Railroad Company, Pittsburgh, Pa.; M. W. Baldwin, Esq., and G. H. Hart, Esq., Pennsylvania Legislature; Edward Miller, Esq., Civ. Eng., George Erety, Esq., Prof. John F. Frazer, Prof. John C. Cresson, and A. B. Huston, Esq., Philadelphia.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer's statement of the receipts and payments for February, was read.

The Board of Managers and Standing Committees reported their minutes.

The Actuary reported the organization of the Board of Managers, and some of the Standing Committees for the ensuing year, by the election of their chairmen, and appointing the time for holding their stated meetings, as follows:

Managers,	John E. Addicks, Chairman.	
	T. J. Weygandt, Isaac S. Williams, } Curators.	2d Wednesday Evening.
Committees.		
On the Library,	James H. Cresson, Chairman,	1st Tuesday "
" Cabinet of Models,	Edw. P. Eastwick, "	1st Thursday "
" Exhibitions,	John E. Addicks, "	" " "
" Meetings,	Dr. B. H. Rand, "	2d Monday "
" Science and the Arts,	Prof. John C. Cresson, "	2d Thursday "

New Candidates for membership in the Institute (2) were proposed, and those candidates proposed at last meeting (5), were duly elected.

Mr. Lifler exhibited and explained a model of his improvement in carriage axles.

Mr. Leeds submitted to the meeting, a number of specimens of iron, in the form of sheets and ships' spikes, coated with copper and brass, manufactured by Mr. E. G. Pomeroy, by the process invented by him, and described in the Journal of the Institute, Vol. xxv, 3d Series, page 213. These specimens show a decided improvement in finish obtained by practice over those formerly shown.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on Instruments for the Cure of Stammering.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom were referred for examination, "Instruments for the Cure of Stammering," invented by Mr. Robert Bates, of Philadelphia, Pennsylvania—REPORT:

That much discrepancy of opinion has prevailed as to the cause and consequent treatment of stammering. Many of the earlier writers have attributed all the varieties of this form of defective speech to some organic affection of the vocal apparatus, or malformation of the parts that compose the mouth and fauces; as, for example, hypertrophy of the tongue, a too low position of that organ in the mouth, enlargement of the tonsils, uvula, &c. The treatment based upon these erroneous and limited views as to the cause, was necessarily as various as it was unsuccessful. Thus rollers were placed under the tongue, to obviate its fancied depression, (Mad. Leigh's treatment;) the tonsils and uvula were excised, deep gashes made in the tongue to lessen its size, &c. Others, again, traced the defect to a want of nervous power in the tongue, occasioned by paralysis of the ninth nerve, and attempted to overcome it by the use of stimulating masticatories, electricity, &c.

In all these instances it is obvious that a *special* was mistaken for a *general* cause.

A more accurate knowledge of the anatomy and physiology of the organs of phonation led to an improvement on the above restricted conjectures. Schulthess, Arnott, Müller, and several other very eminent physiologists, maintained that stammering, in all its varieties, is dependent for its immediate cause upon a *spasmodic closure of the glottis*, producing a sudden arrestation of the issuing column of air.* Later researches, however, have shown that this is true of the guttural sounds only.

Dr. Carpenter† is disposed to consider that the proximate cause, in the majority of cases, is a disordered action of the nervous centres of a centric origin. This is proved by the close analogy which prevails between the phenomena of stammering and those of the general disease, chorea. The great difficulty, in by far the largest number of cases, is to be sought for in the *spasmodic action of certain of the muscles concerned in the production of voice and in articulation*, which spasmodic action impedes or entirely arrests the column of sounding breath. This view is particularly contended for by Dr. Dunglison.‡

Dr. Arnott§ proposes, as a cure for the disease, that the patient should connect all his words by a vocal intonation, in such a manner that there shall be no stoppage of breath. This is, undoubtedly, the correct principle, although it often fails in consequence of the method advocated, not being able to carry out the principle in all cases. This was observed by Müller, who admits that the plan is founded on a sound physiological view of the nature of the affection, but urges the very proper objection, that though it may and does afford some benefit, it cannot do everything,

*Müller.—Elements of Physiology,
†Carpenter's Principles of Human Physiology.
‡Medical Examiner, July, 1852.
§Elements of Physics, Vol. I.

since the main impediment occurs in the middle of words themselves. This is a legitimate objection, as shown by the fact, that the temporary inability to enunciate may occur at the commencement of either syllable of a word, especially those commencing with a consonant; the vowels being formed between the vocal cords, and issuing without change, while the consonants require for their enunciation difficult and often complex and delicate movements of the muscles concerned in articulation.

Mr. Bates, by an independent course of investigation and observation upon himself and others laboring under stammering, has arrived at the same conclusion concering the difficulty to be overcome as is entertained by the modern physiological school.

The instruments invented by him are all based upon the same principle, and, in the opinion of the committee, are more efficient in obviating the vocal defect in question than any other contrivance or method with which they are acquainted. As the spastic difficulty obviously accompanies different sets of letters in different persons, Mr. B. has invented three varieties of instruments, as applicable to all the forms of stammering, all having the same object in view, however—the maintenance of an uninterrupted current of sonorous breath.

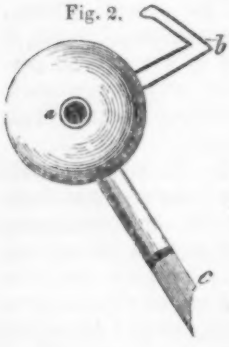
His instruments are as follow :—

Fig. 1.

1. A narrow, flattened tube of silver, $\frac{7}{8}$ths of an inch in length, very light, thin, and smooth. The diameter of the calibre of the tube, measured from the inner edge of one side to the inner edge of the other, is $\frac{3}{8}$ths of an inch, while the depth, measured from the anterior inner edge to the posterior, is $\frac{1}{16}$th of an inch. This is applied to the roof of the mouth, in the median line, in such a manner that the anterior end is lodged just behind the teeth, while the posterior opens into the mouth, looking upwards and backwards towards the fauces. In this position it is maintained by a delicate piece of wire or thin slip of india rubber fastened to one end of the tube, the other passing between the incisor teeth of the upper jaw.

This tube is intended to overcome the difficulty in the pronunciation of the linguo-palatal letters, which are formed by the application of the tongue to the palate. This it accomplishes by preserving a continuous current of air, thereby preventing spasm, allowing the letter in fault to be properly elicited, and thus restoring the self-confidence of the sufferer.

Fig. 2.

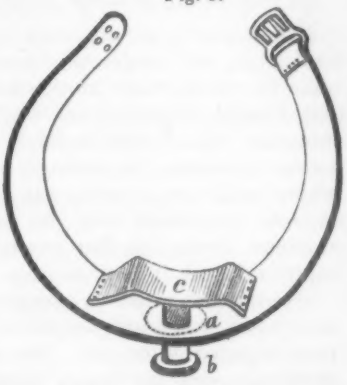


2. For the explosive consonants, the labials, dento-labials, &c., the contrivance consists of a hollow, bi-convex disk, from one end of which projects a silver tube, which, passing out between the lips, keeps up the communication between the atmosphere and the oral cavity. The current of air from the glottis enters by means of a small hole (*a*) at one side of the disk, and escapes through the silver tube. Finding that the saliva was apt to accumulate in the disk, and thus obstruct the entrance and exit of air, the inventor has re-

cently substituted for this lateral opening a small tube, (*b*,) passing from the upper edge of the disk, and bent at an acute angle upon itself.

3. For the accurate elimination of the guttural sounds, Mr. B. has contrived a belt, made of patent or glazed leather, or any other strong material, and lined with morocco. This belt is concealed in an ordinary stock or cravat, and in this manner secured around the neck. In the middle and on the anterior surface of this belt is fitted a metallic plate (*a*), through which passes a regulating screw (*b*). On the inner side of the belt, and just opposite the plate, is a metallic spring (*c*), covered with kid or any other soft material, and firmly sewed by both ends to the strap. When this apparatus is adjusted about the neck, the regulating screw resting upon the spring causes the latter to be forced inward, so as to press more or less strongly upon the thyroid cartilage, thus relaxing the rima-glottidis by approximating the thyroid to the arytenoid cartilages. In this manner the exit of air is provided for, and the spasmodic action of the muscles that close the glottis is overcome. The pressure upon the larynx can be increased or diminished, as may be required.

Fig. 3.



From the above description it will be seen that the efficiency of these instruments is entirely dependent upon the unobstructed channel which they preserve for the egress of the vibrating column of breath from the larynx, through the mouth, into the open air. Muscular spasm is necessarily removed, and the self-confidence of the stammerer restored—undoubtedly the great desideratum in this affection. When the patient is fully convinced that he can really enunciate the opposing letters as distinctly as his friends, he rapidly overcomes the disease, by the judicious and effective exertions which renewed confidence begets.

An advantage of some importance possessed by this apparatus is, that it can be worn without attracting notice, two of the pieces—the tube for the palatal and the belt for the guttural sounds—being entirely concealed; while the tube which projects externally from the silver disk may be disguised by slipping over it the barrel of a quill, cut like a tooth-pick. (Fig. 2, *c*.) Moreover, each of the pieces can be most easily and expeditiously applied, as occasion may require.

In consideration of the advantages here set forth, the committee would recommend that the first premium be awarded to Mr. Bates, for the instruments deposited by him at the last Exhibition of the Institute; and furthermore, that the Scott legacy premium be awarded him for his ingenious and useful invention.

By order of the Committee,

WILLIAM HAMILTON, *Actuary.*

January 12th, 1854.